University of Tartu

Department of Psychology

Kärol Soidla

FACETS OF PERFECTIONISM, IMPULSIVITY AND THEIR ASSOCIATIONS WITH EATING DISORDER SYMPTOMS: A LATENT PROFILE ANALYSIS

Master´s thesis

Supervisor: Kirsti Akkermann, PhD

Subtitle: Latent profiles of ED

Tartu 2017

Table of Contents

Abstract

Perfectionism and impulsivity are both found to play a central role in the etiology of eating disorders (ED). Classifying ED patients based on personality traits have shown clinical utility and revealed valuable information about the otherwise heterogeneous sample of ED patients. We aimed to find latent profiles based on facets of perfectionism, impulsivity and ED symptoms. The changes in ED symptoms before and after inpatient treatment were also assessed. The latent profile analysis was performed on a sample of 274 women, of whom 164 were ED patients and 110 healthy controls. ED patients were diagnosed with bulimia nervosa (n=79), anorexia nervosa restricting (n=59), anorexia nervosa binge-eating/purging type (n=11), or binge eating disorder (n=13). We identified the 5-class model to be the best fit. The five emerged classes were named: 1) resilient (low perfectionism/moderate impulsivity levels;n=23), 2) healthy (low perfectionism/low impulsivity levels; n=142), 3) restrictive (moderate perfectionism/low impulsivity levels;n=53), 4) emotionally dysregulated (high perfectionism/high impulsivity levels;n=16), 5) behaviorally dysregulated (moderate perfectionism/high impulsivity levels;n=40) class. The data for assessing changes in ED symptoms was available for a subsample of 39 ED patients. Members of restrictive and behaviorally dysregulated class showed a significant decrease in ED symptoms at the end of the inpatient treatment, while members of emotionally dysregulated and healthy class had no changes. Our findings support the meaningfulness of classifying ED patients based on perfectionism, impulsivity and ED symptoms, and emphasize the importance of considering personality profiles in treatment planning.

Keywords: latent profile analysis (LPA), perfectionism, impulsivity, eating disorders

Kokkuvõte

Perfektsionismi ja impulsiivsuse tahud ning nende seos söömishäire sümptomitega: Latentsete profiilide analüüs

Nii perfektsionism kui impulsiivsus mängivad söömishäirete (SH) kujunemisel keskset rolli. SH patsientide klassifitseerimine isiksuseomaduste põhjal on näidanud kliinilist kasulikkust ja andnud väärtuslikku informatsiooni muidu heterogeense SH patsientide valimi kohta. Meie eesmärgiks oli leida perfektsionismi, impulsiivsuse ja SH sümptomite alusel latentseid profiile. Lisaks uuriti muutusi SH sümptomaatikas enne ja pärast statsionaarset haiglaravi. Latentsete profiilide analüüs viidi läbi 274 naise valimil, kellest 164 olid SH patsiendid ja 110 terved kontrollid. SH patsientidel oli diagnoositud kas *bulimia nervosa* (n=79), *anorexia nervosa* piirav alatüüp (n=59), *anorexia nervosa* liigsöömise/väljutamise alatüüp (n=11) või liigsöömishäire (n=13). Leidsime, et 5-klassiline mudel on kõige paremini sobiv lahend. Leitud 5 klassi nimetasime: 1) kohanev/toimetulev (madal perfektsionismi/mõõdukas impulsiivsuse tase;n=23), 2) terve (madal perfektsionismi/madal impulsiivsuse tase;n=142), 3) piirav (mõõdukas perfektsionismi/madal impulsiivsuse tase;n=53), 4) emotsionaalselt düsreguleeritud (kõrge perfektsionismi/kõrge impulsiivsuse tase; n=16), 5) käitumuslikult düsreguleeritud (mõõdukas perfektsionismi/kõrge impulsiivsuse tase; n=40) klass.Andmed SH sümptomite muutuste hindamiseks enne ja pärast statsionaarset haiglaravi olid saadaval 39 SH patsiendi puhul.Piirava ja käitumuslikult düsreguleeritud klasside liikmete puhul ilmnes märkimisväärne SH sümptomite alanemine statsionaarse haiglaravi lõpuks, samas kui emotsionaalselt düsreguleeritud ja terves klassis ei ilmnenud muutusi. Meie tulemused toetavad SH patsientide perfektsionismi, impulsiivsuse ja söömishäire sümptomite alusel klassifitseerimise tähenduslikkust ning rõhutavad isiksuse profiilide kaasamise tähtsust SH ravis.

Märksõnad:latentsete profiilide analüüs (LPA), perfektsionism, impulsiivsus, söömishäired

Introduction

Eating disorders (ED) are severe psychiatric disorders (Klump, Bulik, Kaye, Treasure, & Tyson, 2009), which are associated with elevated mortality rate (Smink, van Hoeken, & Hoek, 2012) and many other negative consequences, such as complications in cognitive, emotional and social functioning (American Psychiatric Association (APA), 2013). The etiology of ED and disordered eating behavior is a complex combination and interaction of biological, psychological and sociocultural risk factors (Culbert, Racine, & Klump, 2015).

DSM-5 recognizes three major eating disorders: anorexia nervosa (AN), bulimia nervosa (BN) and binge eating disorder (BED), further dividing anorexia nervosa into restricting (AN-R) and binge-eating/purging (AN-BP) subtypes. ED which can not be categorized under those diagnoses are classified as Other Specified or Unspecified Feeding or Eating Disorders (OSFED) (APA, 2013), or as previously in DSM-IV Eating Disorder not Otherwise Specified (APA, 2000). Several symptoms are shared across diagnoses (e.g. cognitive features like overvaluation of weight and shape, behavioral features like dietary restriction, compensatory behaviors, and binge eating) (Culbert et al., 2015).

Alternative classification of eating disorders

There is a growing interest in alternative ways to classify ED as the debate between categorical and dimensional classification in ED continues (Insel et al., 2010; Lilenfeld, Wonderlich, Riso, Crosby, & Mitchell, 2006; Wildes & Marcus, 2013). Current categorical classification of ED has several limitations, including high symptom variability within diagnosis, lack of diagnostic stability, high rates of EDNOS diagnoses, and complications with predicting treatment response (Inselt et al., 2010; Keel, Brown, Holland, &Bodell, 2012; Krueger, Watson, & Barlow, 2005; Widiger & Samuel, 2005; Wonderlich, Joiner, Keel, Williamson, & Crosby, 2007). In addition, current diagnostic criteria in DSM-5 do not provide adequate information about possible mechanisms, which may cause and maintain ED, making it harder to develop effective intervention strategies (Insel et al., 2010) and complicating research (Wildes and Marcus, 2013).

According to Wildes and Marcus (2013), two main alternative models have been proposed and described. The first model focuses on classifying individuals on the basis of ED symptoms and the second classifying individuals on the basis of comorbid psychopathology and associated features, including personality traits. The second model is particularly

promising, as comorbid psychopathology and personality traits may reflect different pathways to disordered eating (Westen & Harden-Fischer, 2001) and help to explain clinical course and treatment prognosis, heterogeneity in symptomatic profiles and maintenance of ED (Farstad, McGeown, & von Ranson, 2016).

Undercontrolled, overcontrolled and low comorbid psychopathology classes

Studies, which have investigated ED patients based on personality traits and comorbid psychopathology have proposed three to six class solutions (e.g Krug et al., 2011; Thompson-Brenner et al., 2008a; Turner et al., 2014; Westen & Harden-Fischer, 2001). It is interesting, that several studies, regardless of the sample, type of assessment and statistical analyses used, have identified three main distinctive classes: 1) undercontrolled class, which is characterized by impulsivity, high emotional reactivity, risky behaviours and high neuroticism, 2) overcontrolled class, which is characterized by high perfectionism, rigidity, compulsivity, inhibition, avoidance, high neuroticism and conscientiousness and 3) resilient, high functioning or low (comorbid) psychopathology class (for an overview see Wildes & Marcus, 2013; e.g. Holliday, Landau, Collier, & Treasure, 2005; Jacobs et al., 2009, Wonderlich et al., 2005). In studies, which have found more than three classes to be the best solution, an undercontrolled, overcontrolled and resilient class is still recognizable (e.g. Krug et al., 2011; Thompson-Brenner et al., 2008a). For example, Thompson-Brenner et al. (2008a) found support for a five class model consisting of following classes 1) high functioning (low levels of personality pathology) 2) behaviorally dysregulated (impulsive behavior in at least two areas) 3) emotionally dysregulated (affective instability, marked shifts from normal mood to depression or anxiety, angry outbursts and overreaction to minor events) 4) avoidant-insecure (lack of self-confidence, low self-esteem, inability to relax) 5) obsessional-sensitive (perfectionism, preoccupation with details, overreaction to minor events, indecisiveness).

The high functioning class has been found to be associated with less comorbid psychiatric disorders, while undercontrolled class has been associated with more externalizing disorders, substance abuse, and overcontrolled class with more comorbid internalizing disorders, e.g anxiety and mood disorders (Thompson-Brenner, Eddy, Satir, Boisseau, & Westen, 2008b; Thompson-Brenner & Westen, 2005; Wonderlich et al., 2005).

One possible and promising way to classify ED patients is to use measures of perfectionism and impulsivity, as it has been found that both, personality traits which are associated with undercontrolled behaviors (like impulsivity) and overcontrolled or compulsive traits (like

perfectionism) are central features of ED (Bardone-Cone et al., 2007; Boone, Claes, & Luyten, 2014; Farstad et al., 2016; Slof-Op't Landt, Claes, & Furth, 2016; Waxman, 2009).

Perfectionism and eating disorders

The centre of perfectionism is setting unrealistically high standards for oneself (Pearson & Gleaves, 2006; Frost, Marten, Lahart, & Rosenblate, 1990) and it is believed that perfectionism is maintained by biased evaluations of one´s accomplishments and overly critical thoughts about (possible) failure (Shafran, Cooper, & Fairburn, 2002). The essence of perfectionism becomes more clear if it is treated as a multidimensional construct, which has both adaptive and maladaptive dimensions (Rice & Preusser, 2002; Lo & Abbott, 2013). According to Frost et al. (1990) perfectionism is divided into six dimensions: Organization, Personal standards, which are thought to be adaptive dimensions, and Concern over mistakes, Doubts about actions, Parental criticism and Parental expectations, which are thought to be maladaptive dimensions (Stoeber & Otto, 2006). Perfectionism has been characterized as an overcontrolling personality trait, having considerable overlap with obsessive-compulsive symptoms (Pinto et al., 2017).

Perfectionism is considered as a risk and maintaining factor for ED (Bardone-Cone et al., 2007; Culbert et al., 2015; Egan & Wade, 2011). Evaluative concerns dimension of perfectionism has been found to be strongly associated with psychopathology in general. (Stoeber & Otto, 2006). In ED, both adaptive and maladaptive dimensions have been linked to disordered eating behaviors like dieting, bulimic symptoms, preoccupation with food, weight and shape and compensatory behaviours like laxative use, vomiting and compulsive exercise (e.g. Bardone-Cone et al., 2007; Egan & Wade, 2011; Lichtenstein, Hinze, Emborg, Thomsen, & Hemmingsen, 2017). In addition, it has been found in a person-centred study that a combination of high Personal standards and high Evaluative concerns is associated with the highest level of ED symptoms, such as restrained eating, concern over eating, weight, and shape (Boone et al., 2014; Boone, Soenens, Braet, & Goossens, 2010).

All eating disorder diagnoses tend to be characterized by elevated perfectionism, but strongest associations have been found with AN and BN (Farstad et al., 2016; Hilbert et al., 2014; Soenens et al., 2008). Relations with BED are less clear, however, it has been proposed that fasting or restrained eating might be the mediating factor between perfectionism and BED (Forbush, Heatherton, & Keel, 2007; Sherry & Hall, 2009). It has been found that perfectionism is associated with an array of disordered eating behaviors, but the associations

were strongest for fasting (or restrained eating) and purging (Forbush et al., 2007). Perfectionism has also been found to be heightened in overweight women and is associated with emotional eating, night eating and disordered eating attitudes (Quick, Byrd-Bredbenner, & Neumark-Sztainer, 2013). It has been found that AN patients tend to report higher levels of Personal standards (Wade et al., 2008), whereas those with BN have reported higher scores on Parental criticism subscale (Boiusseau, Thompson-Brennner, Pratt, Farschione, & Barlow, 2013).

Impulsivity and eating disorders

Impulsivity can also be conceptualized as a multidimensional construct. The two most widely used approaches to measure impulsivity divide it into negative urgency (tendency to act reckless and without further thought in stressful situations while experiencing negative affect), positive urgency (tendency to engage in impulsive behavior when experiencing strong positive emotions), lack of premeditation, sensation seeking, lack of perseverance (Whiteside & Lynam, 2001), and into attentional (inability to focus attention or concentrate), motor (acting without thinking) and non-planning (lack of forethought) impulsivity (Patton et al, 1995). One possible way to divide impulsivity is into functional and dysfunctional domains. Functional impulsivity is characterized by quick thinking and response style, dysfunctional impulsivity by recklessness and excessive haste (Dickman, 1990).

Negative urgency is proposed to be the most important expression of impulsivity in ED (e.g. Anestis, Selby, & Joiner, 2007; Black and Mildrer, 2014; Fischer, Peterson, & McCarthy, 2013; Fischer, Smith, & Cyders, 2008). Also, associations between ED and inattention, motor impulsivity (Boisseau et al., 2012; Lundahl, Wahlstrom, Christ, & Stoltenberg, 2015) and positive urgency (Claes et al., 2015) have been demonstrated. As known to the author, the relations between dysfunctional and functional impulsivity and disordered eating behavior have only been examined in one study before (Slof-Op't Landt et al., 2016).

The association between disordered eating behavior and impulsivity is strongest within ED subtypes characterized by binge eating or purging behaviors, like BN, BED and AN-BP (Beck, Smits, Claes, Vandereycken, & Bijtterbier, 2009; Cassin &von Ranson, 2005; Claes, Vandereycken, & Vertommen, 2005; Favaro et al., 2005; Waxman, 2009). The relationship between AN and impulsivity is less clear (Favaro et al., 2005; Claes et al., 2005) as associations are found to be stronger with AN-BP compared to AN-R subtype (Claes et al., 2015; Fassino, Amianto, Gramaglia, Facchini, & Abbate-Daga, 2005). On the other hand,

heightened levels of impulsive behavior have been found in all ED subgroups, including restricting types (Claes, Robison, Muehlenkamp, Vandereycken, & Bijtterbier, 2010; Thompson-Brenner et al., 2008c) and suggested to be a characteristic factor for all ED. So it has been concluded that impulsivity does not differentiate well between ED diagnoses, but rather their clinical presentation (Boisseau, Thompson-Brenner, Eddy, & Satir, 2009; Waxman, 2009).

Impulsivity has also been associated with severity of eating pathology (Favaro et al., 2005). Fully recovered BN patients report lower levels of negative urgency, which are similar to healthy controls, compared to patients who are currently ill (Bardone-Cone, Butler, Balk, & Koller, 2016).

Interactions between perfectionism and impulsivity

As stated by Boone et al. (2014) there are two main reasons why impulsivity and perfectionism are expected to interact. Firstly, the literature about diagnosis migration shows relatively frequent crossover between AN and BN diagnoses and AN-R and AN-BP subtypes (Eddy et al., 2008; Peat, Mitchell, Hoek, & Wonderlich, 2009) and it is hypothesized that those diagnostic categories may share etiological pathways (Hilbert et al., 2014), which could be explained by interactions between perfectionism and impulsivity. Secondly, EDs are characterized by both compulsive and impulsive behaviors which have found to be positively correlated in BN patients (Engel et al., 2005). In addition, combinations of high perfectionism and high impulsivity can be found in groups of individuals with the same diagnosis or even within the same individual (Claes, Vandereycken, & Vertommen, 2002). It has been suggested that these trait interactions may be mediating factors in the etiology of EDs and obsessive compulsive disorder. For example, perfectionism may regulate impulsive behavior or perfectionism´s role as a maintaining factor may vary depending on whether impulsive tendencies are present or not (Altman & Shankman, 2009).

Two studies have previously examined the interplay between perfectionism and impulsivity, classifying individuals based on their perfectionism and impulsivity scores (Boone et al., 2014; Slof-Op't Landtet al., 2016). Though both studies have found four latent classes, there are differences in proposed classes. Boone et al. (2014) study was conducted on healthy adolescents using cluster analysis methodology and the four following clusters were identified: 1) resilient, 2) pure perfectionism, 3) pure impulsivity, 4) combined perfectionism/impulsivity cluster. The highest level of ED psychopathology was reported by individuals who belonged to the combined cluster. Slof-Op't Landt et al. (2016) study, which

was conducted in a clinical sample of ED patients, found support for following four classes: 1) healthy impulsivity, 2) unhealthy impulsivity, 3) both healthy and unhealthy perfectionism, 4) healthy perfectionism. ED psychopathology was highest in the healthy/unhealthy perfectionism class. Those two studies did not include ED symptoms in the cluster or latent profile analysis, which may have influenced the results. Including ED symptoms as indicators in the model may reduce bias and produce stronger relations between symptoms and possible risk factors in classes (Lanza, Tan, & Bray, 2013).

Personality based classification and treatment response

Another benefit of classifying individuals to more homogenous subgroups is that focusing on traits which are more stable than ED symptoms, may result in better treatment planning as it enables to identify possible etiological mechanisms which to focus intervention on (Wildes & Marcus, 2013). In addition, as variations in the treatment response among individuals with the same diagnosis may in part be due to within-group differences, subtype specific interventions may offer a novel solution (National Insitute of Mental Health (NIMH), 2008). Classes based on personality traits have demonstrated to predict treatment and clinical outcomes better than ED diagnoses or their subtypes. Undercontrolled class has been associated with less successful treatment response, greater risk of discharge against medical advise and readmission relative to overcontrolled and high functioning class (Wildes et al., 2011). Furthermore, individuals in the undercontrolled class have been found to be less likely rated as recovered by their therapist (Westen & Harden-Fischer, 2001).

Both perfectionism and impulsivity may also play an important role in predicting and influencing treatment outcome. Egan and Wade (2011) have proposed that perfectionism is a transdiagnostic construct which is associated with high levels of comorbidity and poor treatment outcomes. Impulsivity has also been associated with poor treatment outcomes and higher rates of relapse after treatment (Keel & Michell, 1997; Waxman, 2009; Westen & Muderrisoglu, 2006).

Purpose of the current study and hypothesis

The purpose of the current thesis is to classify individuals based on dysfunctional and functional impulsivity, maladaptive and adaptive perfectionism dimensions and disordered eating behavior (restrained eating, binge eating, purging and preoccupation with body image and body weight). Classes are then compared on levels of perfectionism, impulsivity, ED

symptoms and personality traits. The frequency of ED and comorbid diagnoses in classes are examined. Also, changes in ED symptoms before and after inpatient treatment are investigated. Although two previous studies have already examined the interplay between perfectionism and impulsivity, neither of them had ED symptoms as indicators in the analysis or investigated differences between classes in relation to changes in ED symptoms.

Based on the previous literature the following hypotheses were postulated:

1. At least a four class solution emerges.

2. Emerged classes resemble the well established three classes (overcontrolled, undercontrolled and high functioning class).

3. Classes are expected to differ on eating disorder symptoms, personality variables and frequency of ED and comorbid diagnoses.

   It is expected that the class which resembles undercontrolled class displays the highest level of ED symptoms and mostly binge-eating and purging behaviors, while overcontrolled class displays mostly restrained eating.

   Undercontrolled class is expected to have more patients with BN and AN-BP and comorbid substance abuse disorders, while overcontrolled class is expected to have more patients with AN-R, mood and anxiety disorders.

4. The class membership is expected to predict changes in ED symptoms after inpatient treatment. The ED symptoms are expected to significantly decrease in classes resembling overcontrolled and high functioning/resilient class, but not in undercontrolled class.

Methodology

Participants

The sample comprised of 164 ED patients whose age ranged from 13 to 48 (M=22.43, SD=7.03), and of 110 age and education matched healthy controls whose age ranged from 14 to 47 years (M=24.41, SD=8.19). Altogether the sample consisted of 274 women. 10.2% of the participants had primary education, 30.3% basic education, 32.1% secondary education, 11.3% vocational secondary education and 15.1% higher education.

Patients were recruited from the inpatient unit of Tartu University Clinics Eating Disorders Centre. The focus of inpatient treatment is to restore regular eating pattern and normalize caloric intake in a controlled setting. All the patients who were hospitalized were given the opportunity to participate in the study. The patients were either diagnosed with AN-R (n=59) and AN-BP (n=11), BN (n=79) or BED (n=13). All of the patients with BN had binge/purge subtype. Patients were recruited during the studies „Eating disorders and serotonin-related biomarkers" and „Inhibitory control and emotional bias in eating disorder patients". During the latter study the patients were assessed twice, the data was available for a subsample of 39 patients.

Healthy controls were recruited via public advertisements and university lists using chain sampling method. Controls were students from the University of Tartu, high school students and employers of public service and different private service branches. Healthy controls were screened for any psychiatric disorders with MINI Neuropsychiatric Interview (Sheehan, Lecrubier, Sheehan, & Amorim, 1994; Estonian version Shlik, Aluoja, & Kihl, 1999). The data on second assessment was available for 25 controls.

Measures

Demographic data. Participants were asked about their age, education level, height, weight, and medications taken during the study period. For the patients, the information about ED and comorbid disorder diagnoses and duration of the disorder was added. The form of demographic data was filled in by psychiatrist or clinical psychologist. BMI (kg/height m^2) was calculated based on participants actual weight and height, which was measured by standardized procedures in the hospital.

Clinical interview (The Mini-International Neuropsychiatric Interview MINI 5.0.0; Sheehan, Lecrubier, Sheehan, & Amorim, 1994; Estonian version Shlik, Aluoja, & Kihl, 1999) is a short structured psychiatric interview, which was developed to diagnose DSM-IV and ICD-10 mental disorders. Expanded version of eating disorders module of the Structured Clinical Interview for DSM-IV-TR Axis I Disorders (SCID-I/NP; First, Spitzer, Gibbon, & Williams, 2002) was used if necessary to specify ED diagnoses. Clinical interviews were conducted by a clinical psychologist or psychiatrist.

Multidimensional Perfectionism Scale (MPS) (Frost, Marten, Lahart, & Rosenblate, 1990; Estonian version Saarniit, 1990). The Estonian version consists of 28 self-report items, which are answered on a 5-point Likert scale (from „strongly disagree" to „strongly agree").

As a result of the factor analysis four factors were extracted and named similarly to the original subscales: 1) Organization, 2) Personal standards, 3) Concern over mistakes/Doubts about actions, 4) Parental criticism/Parental expectations. First two form the positive (or adaptive) subscale of perfectionism and latter two negative (or maladaptive) perfectionism subscale. In the current study, all subscales were used, as previous studies have found associations between ED and both negative and positive dimensions of perfectionism (Bardone-Cone et al., 2007). The Cronbach α for subscales ranged between 0.75-0.95.

Dickman´s Impulsivity Inventory(DII) (Dickman, 1990; Estonian version Kuppart, 2005) is a 24-item questionnaire, which is answered on a 5-point Likert scale (from „totally agree" to „do not agree at all"). It is divided into two subscales 1) Dysfunctional impulsivity, which is the tendency to act with relatively little forethought in situations where it causes problems (is non-optimal), and 2) Functional impulsivity, which is the tendency to act with relatively little forethought and make quick decisions when such style is optimal.

Eating Disorders Assessment Scale(EDAS) (Akkermann, Herik, Aluoja, & Järv, 2010) is a 29-item self-report questionnaire, which assesses eating disorder symptoms. Items are answered on a 6-point Likert scales (from „never" to „always"). The scale consists of four subscales 1) Restrained eating, 2) Binge eating, 3) Purging, 4) Preoccupation with body image and body weight. The scale was designed to screen people with ED from the population sample and to discriminate patients with AN, BN, and BED. The α coefficient for the EDAS total scale was 0.96, subscales ranging between α=0.84-0.96.

Swedish Universities Scales of Personality (SSP; Gustavsson, Bergman, Edman, Ekselius, von Knorring, & Linder (2000), Estonian version Shlik, Aluoja, Graf, & Männik, 2001). SSP measures personality traits associated with psychopathology and consists of 91 self-report items, which are answered on a 4-point Likert scale (from „does not apply at all" to „absolutely true"). The questionnaire has 13 subscales: 1) Somatic trait anxiety, 2) Psychic trait anxiety, 3) Stress susceptibility, 4) Lack of assertiveness 5), Impulsiveness 6), Adventure seeking, 7) Detachment, 8) Social desirability, 9) Embitterment, 10) Trait irritability, 11) Mistrust, 12) Verbal trait aggression, 13) Physical trait aggression.

Montgomery-Åsberg Depression Rating Scale self-reported version (MADRS-S; Svanborg & Åsberg, 1994) has nine items and it is constructed on the basis of the original expert-rated scale of MADRS (Montogomery & Åsberg, 1979). The scale is used to assess the

severity of depression and changes in symptoms. Higher score in MADRS-S indicates more severe depression.

The Obsessive-Compulsive Inventory-Revised (E-OCI-R; Foa, Kozak, Salkovskis, Coles, & Amir, 1998; Foa et al., 2002; Estonian version Säde, 2016). 21 items are evaluated on a 5-point Likert scale (from „not at all" to „extremely/very much"). The scale consists of seven subscales: 1)Checking 2) Washing 3) Obsessing 4) Neutralizing 5) Ordering 6) Hoarding 7) Doubting. In the current study, only the total score of OCI-R was used to examine associations with perfectionism dimensions and to confirm the overcontrolling/compulsive nature of perfectionism. The Cronbach α for OCI-R total score was 0.93.

Procedure

The study was approved by the Ethics Review Committee on Human Research of the University of Tartu. Written informed consent was obtained from the participants.

State questionnaires (EDAS, MADRS-S, OCI-R) were filled in on the first days of hospitalization and trait questionnaires (DII, MPS, SSP) were filled in during the first week of hospitalization. Healthy controls filled the trait questionnaires at home and state questionnaires were administrated in a laboratory at the university setting. In Study 2 state questionnaires were also filled in on the last day of hospitalization (days between testing ranging from 6 to 98, M=36.3, SD=25.9). Data from the control group during this study was also collected twice (days between testings ranging from 25 to 81, M=37.6, SD=19.0).

The author of the present thesis did not take part in the data collection. The author contributed by scoring the data, organizing database, doing literature search and analysis, analyzing data, integrating literature and writing the manuscript.

Statistical analysis

Latent profile analysis (Gibson, 1959; Vermunt & Magidson, 2002) is a model based, person centered classification method. The primary goal of latent profile analysis is to model heterogeneity in population by, based on response patterns, classifying individuals to more homogenous subgroups. Each individual's membership in classes is based on posterior probabilities. Posterior probabilities are calculated for each individual for every latent profile and latent profiles are based on these probabilities(Berlin, Williams, & Parra, 2014; Oberski, 2016).

In the current study, four Frost MPS subscales (Organization, Personal standards, Concern over mistakes, Parental criticism), two DII subscales (Dysfunctional and Functional impulsivity) and four EDAS subscales (Restrained eating, Binge eating, Purging, Preoccupation with body image and body weight) were treated as indicator variables in the model. Latent profile analysis was performed in program Mplus version 6.12. with robust likelihood maximum method. To avoid converging on a local solution 1000 random sets of starting values were used in the initial stage and 250 optimizations were used in the final stage. Bootstrap draws were set for 100, each with two sets of random starting values and one final stage optimization for the model with one less class, 50 sets of random starting values and 15 final stage optimizations for the alternative model (for guidelines see: Muthén & Muthén, 1998-2010).

Model selection was based on the following information criteria: 1) Bayesian Information Criterion (BIC; Schwartz, 1978), 2) Akaike Information Criterion (AIC; Akaike, 1987), 3) Sample-Size Adjusted BIC (SSABIC; Sclove, 1987). Lower values of these three fit statistics indicate better model fit. To estimate the accuracy with which models classify individuals into classes Entropy was used. Entropy value ranges from 0 to 1, higher values showing greater accuracy. Lastly, Bootstrap Likelihood Ratio test (BLRT; McLachan & Peel, 2000) and Lo-Mendell-Rubin test (LMR; Lo, Mendell, & Rubin, 2001) were used to compare if the improvement in the model was statistically significant when one more class was included in the model. Based on the article by Tein, Coxe, & Cham (2013) BIC and BLRT are generally the most widely used, accurate and powerful indices to detect the right number of classes.

Validation analyses were performed in SPSS Statistics version 20. Classes were compared on series of measures assessing ED symptoms, perfectionism, impulsivity and personality traits using one-way ANOVA. Chi-square test of independence was used to compare ED diagnoses and comorbid disorder frequencies between classes. To assess changes in EDAS scores a two-way mixed (repeated measures) ANOVA was conducted using time (first and second measurement scores on EDAS) as a within-subject variable and class membership as a between-subject variable. Days between two measurements, BMI and MADRS scores were included as covariates to control for possible interactions, as it has been found that BMI and comorbid psychopathology may influence treatment outcome (Kruger & Eaton, 2010; Vall & Wade, 2015)

Results

Demographics and descriptive statistics

One-way ANOVA was conducted to compare AN-R, AN-BP, BN, BED patients and healthy controls on age, BMI, duration of eating disorder as well as on mean scores on MPS, DII and EDAS. Gabriel´s post hoc was used to assess differences between the groups. Descriptive data on AN, BN, and BED patients and healthy controls are presented in Appendix 1 Table 1.

Latent profile analysis

Both the patients and the controls were included in the latent profile analysis (N=274). A series of one to seven profile models were estimated based on indicator (MPS, DII, EDAS) variables. In previous research three to six class solutions have been found. Based on recommendations of Ram and Grimm (2009) one more class than maximally has been found in previous studies was estimated. Statistical fit indices of each solution are presented in Table 1. Based on fit indices and considering clinical and theoretical meaningfulness five class model was selected. Although fit indices also decreased in six and seven class models, the change was relatively small.

Table 1. Fit indices for 1-7 class solution.

Classes	Free parameters	LL	AIC	BIC	Adjusted BIC	Entropy	BLRT	LMR
1	20	-9560.53	19161.07	19233.33	19169.91	-	-	-
2	31	-9227.52	18517.05	18629.06	18530.76	0.926	0.0001	0.0001
3	42	-9113.89	18311.78	18463.54	18330.37	0.938	0.0001	0.008
4	53	-9078.19	18262.38	18453.88	18285.83	0.928	0.00001	0.410
5	**64**	**-9031.05**	**18190.11**	**18421.35**	**18218.42**	**0.946**	**0.00001**	**0.320**
6	75	-8994.83	18139.67	18410.65	18172.84	0.934	0.00001	0.425
7	86	-8960.72	18093.44	18404.17	18131.48	0.945	0.00001	0.418

Note: Best fitting model is depicted in bold. LL – log likelihood; AIC – Aikaike information criterion; BIC – Bayesan information criterion; BLRT – Bootstrap Likelihood Ratio test; LMR – Lo-Mendell Rubin test

Clinical features of the 5-class solution

Table 2 depicts the relationship between class membership and ED and comorbid psychopathology. A chi-square test of independence was conducted between ED diagnose categories and class membership. Significant differences emerged among diagnostic categories and classes ($\chi 2_{(16)}$=251.83, p<0.001), the association was moderately strong (Cohen, 1988), Cramer's V = 0.481. Post hoc analyses using standardized residuals with (+/- 1.96) indicating a difference in frequency of ED diagnoses was used. There were significantly more patients with BN in classes 1, 4 and 5 and fewer patients with BN in class 2. A large proportion of patients with BED belonged to classes 3 and 4. There were more AN-BP patients in class 1 and 4 compared to other classes, but more AN-R patients in class 2 and 3. Most of the healthy controls belonged to class 2.

There were no statistically significant associations between class membership and frequency of OCD diagnosis, ($\chi 2_{(4)}$=5.59, p=0.223). Statistically significant differences emerged between class membership and frequency of anxiety disorders ($\chi 2_{(4)}$=29.36, p<0.001, V=0.327), mood disorders ($\chi 2_{(4)}$=34.08, p<0.0001, V=0.353) and alcohol abuse disorder ($\chi 2_{(4)}$=19.99, p=0.001, V=0.270). Post hoc analyses indicated that significantly more patients with comorbid mood disorder belonged to classes 1, 4 and 5 compared to other classes. The highest proportion of patients with anxiety disorders belonged to classes 3 and 4 and a lower proportion to the 2nd class. Most patients with comorbid alcohol abuse disorder belonged to class 5 and least to class 2.

Table 2. Frequency of eating disorder diagnoses and comorbid psychopathology in five classes.

Measures	**1.class** (n=23) 8.4%	**2.class** (n=142) 51.8%	**3.class** (n=53) 19.3%	**4.class** (n=16) 5.8%	**5.class** (n=40) 14.6%
Eating disorder diagnoses					
AN-R	n=2 (8.7%)	n=29 (20.6%)	n=26 (50.0%)	n=1 (6.2%%)	n=0
AN-BP	n=3 (13.0%)	n=4 (2.8%)	n=0	n=2 (12.5%)	n=2 (5.0%)
BN	n=16 (69.9%)	n=4 (2.8%)	n=12 (23.1%)	n=10 (62.5%)	n=37 (92.5%)
BED	n=1 (4.3%)	n=1 (0.7%)	n=8 (15.45%)	n=3 (18.8%)	n=0
Healthy controls	n=1 (4.3%)	n=103 (73.0%)	n=6 (11.5%)	n=0	n=1 (2.5%)
Comorbid psychopathology					
Mood disorders	n=11 (47.8%)	n=23 (16.1%)	n=18 (33.9%)	n=11 (68.7%)	n=19 (47.5%)
Anxiety disorders	n=8 (34.7%)	n=16 (11.3%)	n=21 (39.6%)	n=8 (50.0%)	n=14 (35.0%)
Alcohol abuse disorders	n=4 (17.4%)	n=6 (4.2%)	n=5 (9.4%)	n=2 (12.5%)	n=11 (27.5%)
OCD	n=1 (4.3%)	n=2 (1.4%)	n=4 (7.5%)	n=1 (6.3%)	n=3 (7.5%)

Note: AN-R – anorexia nervosa restricting; AN-BP – anorexia nervosa binge-purging; BN – bulima nervosa; BED – binge eating disorder; OCD – obsessive compulsive disorder

Validation analyses

The final 5-class solution is depicted in Figure 1. Validation analyses were conducted for the five class model on MPS, DII and EDAS subscales. Table 3 presents means and standard deviations for the indicators of each five profile including ANOVA results and pairwise contrasts for statistically significant differences. Gabriel´s post hoc was used to confirm where the differences between classes occurred.

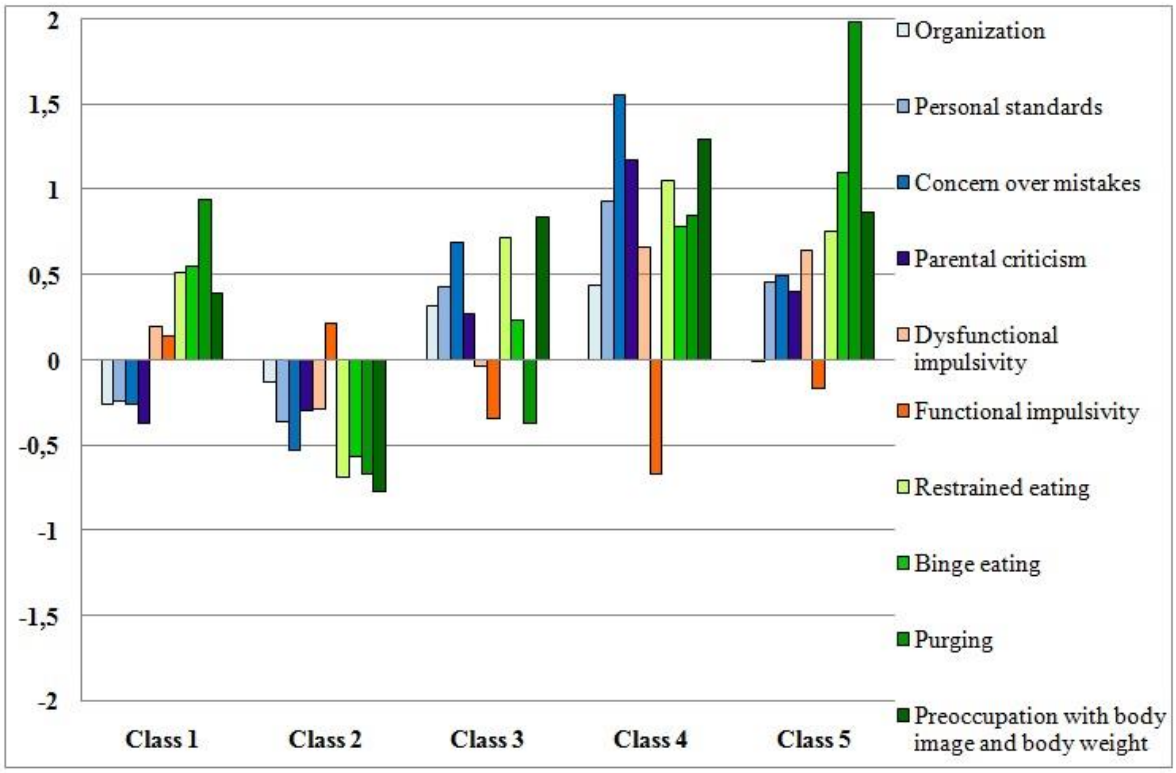

Figure 1. z-scores for Multidimensional Perfectionism Scale, Dickman´s Impulsivity Inventory and Eating Disorder Assessment scale subscales in the five-class solution.

There were no significant differences between the classes with respect to age and BMI.The duration of ED was shortest in classes 2 and 3.

Statistically significant differences across classes emerged for all EDAS subscales. EDAS total score was significantly higher in classes 4 and 5, followed by classes 3 and 1. Class 2 had the lowest scores on all subscales. In relation to Binge eating, classes 5 and 3 had the highest scores. Purging subscale scores were the highest in the 5th class, followed by classes 1 and 4. Preoccupation with body image and body weight was also higher in classes 4 and 5 compared to classes 1, 2 and 3.

In relation to perfectionism, there were significant differences on all scales except Organization. The 2nd class had the lowest scores on subscales Personal standards, Concern over mistakes and Parental criticism and expectations. The 1st and the 2nd class did not differ on any of the scales. The highest perfectionism scores were in the 4th class, comprising significantly higher scores in negative perfectionism scales (Concern over mistakes and Parental criticism) than classes 3 and 5.

The following differences emerged on DII scale: classes 4 and 5 had the highest Dysfunctional impulsivity score which was significantly different from classes 2 and 3. The 2nd class had the highest Functional impulsivity score, the differences were statistically significant for classes 3 and 4 (who had the lowest Functional impulsivity score).

Associations between OCI-R and MPS

In addition, we also used OCI-R to confirm the associations between compulsivity and perfectionism. The data on OCI-R was available for 54 participants. There was a strong positive correlation between OCI-R total score and MPS total score ($r_{(52)}$=0.66, p<0.001), as well as negative perfectionism subscale ($r_{(52)}$=0.65, p<0.001). The correlation between OCI-R and positive perfectionism subscale was moderate ($r_{(52)}$=0.31, p<0.05). In addition, one-way ANOVA revealed significant differences between classes ($F_{(4,53)}$=8.95, p<0.001, partial η^2=0.442), as the class 4, which also had the highest scores on negative perfectionism subscales, had the highest OCI-R scores among the classes (M=42.3, SD=19.9). Scores in other classes were respectively: class 1 (M=22.7; SD=9.0), class 2 (M=11.0; SD=9.2); class 3 (M=24.3; SD=17.9) and class 5 (M=27.0; SD=19.1). The statistically significant differences emerged between classes 2 and 4 (p<0.001).

Table 3. Means, standard deviations and differences on age, BMI, duration of disorder, EDAS, MPS and DII subscales between five classes.

Variables	1.class	2.class	3.class	4.class	5.class	ANOVA		
	M(SD)	M(SD)	M(SD)	M(SD)	M(SD)	$F_{(4,269)}$	p	η^2
Age (years)	22.46(8.67)	23.95 (7.97)	21.76 (6.69)	23.27 (8.16)	23.03 (6.25)	0.86 (4,263)	0.490	0.013
BMI	21.17 (5.62)	20.33 (4.52)	21.07 (8.20)	22.81 (5.11)	21.78 (4.30)	1.14 (4,269)	0.339	0.017
Duration of disorder (years)	6.35 (8.28)	3.59 (4.23)^{d*}	3.43 (3.26)$^{d*, e*}$	7.54 (4.19)$^{b*, c*}$	6.37 (5.24)^{c*}	103.26 (4,149)	0.004	0.099
EDAS								
EDAS total	79.61 (20.92)$^{(b,d,e)**}$	30.10 (14.04)$^{(a,c,d,e)**}$	75.36 (16.03)$^{(b,d,e)**}$	98.25 (12.08)$^{(a,b,c)**}$	100.53 (16.73)$^{(a,b,c)**}$	247.84	<0.001	0.787
Restrained eating	23.70 (8.56)^{b**}	10.75 (7.31)$^{(a,c,d,e)**}$	25.91 (8.02)^{b**}	29.50 (6.53)^{b**}	26.23 (7.65)^{b**}	71.29	<0.001	0.515
Binge eating	22.52 (8.18)^{b**}	10.44(5.96)$^{(a,c,d,e)**}$	19.15(11.34)$^{(b,e)**}$	25.06 (13.66)^{b**}	28.48 (8.55)$^{(b,c)**}$	47.64	<0.001	0.415
Purging	10.65 (2.23)$^{(b,c,e)**}$	0.31 (0.81)$^{(a,c,d,e)**}$	2.19 (2.09)$^{(a,b,d,e)**}$	10.06 (2.14)$^{(b,c,e)**}$	17.40 (1.97)$^{(a,b,c,d)**}$	1116.49	<0.001	0.943
Preoccupation	22.74 (8.92)$^{(b,d)**(c,e)*}$	8.61 (5.84)$^{(a,c,d,e)**}$	28.11 (8.13)$^{(a,d)*b**}$	33.63 (6.34)$^{(a,b)**c*}$	28.43 (8.96)^{a*b**}	130.87	<0.001	0.661
MPS								
Organization	18.87 (4.52)	19.42 (4.38)	21.34 (3.76)	21.88 (3.96)	19.95 (4.51)	3.12	0.016	0.044
Personal standards	14.17 (6.06)$^{(c,e)*d**}$	13.32 (7.06)$^{(c,d,e)**}$	19.21 (6.76)^{a*b**}	23.00 (3.95)$^{(a,b)**}$	19.45 (7.15)^{a*b**}	49.25	<0.001	0.189
Concern over mistakes	7.14 (4.93)$^{(c,d,e)**}$	5.06 (5.06)$^{(c,d,e)**}$	14.40 (7.05)$^{(a,b,d)**}$	21.00 (4.41)$^{(a,b,c,e)**}$	12.88 (7.44)$^{(a,b,c)**}$	15.65	<0.001	0.424
Parental criticism	5.52 (6.16)$^{(c,e)*d**}$	6.10 (6.26)$^{(c,d,e)**}$	10.17 (6.83)$^{a** (b,d)**}$	16.69 (7.91)$^{(a,b,c,e)**}$	11.10 (7.26)$^{(a,d)*b**}$	14.18	<0.001	0.174
DII								
DFI	17.78 (5.49)	14.06 (6.80)$^{(e,d)**}$	15.96 (7.35)$^{(d,e)*}$	21.31 (10.44)^{b**c*}	21.20 (7.94)$^{(b,c)**}$	10.12	<0.001	0.132
FI	24.39 (7.86)	25.00 (7.69)$^{(c,d)**}$	20.40 (9.11)^{b**}	17.75 (6.59)^{b**}	21.83 (7.59)	5.77	<0.001	0.079

Note: η^2- partial eta squared; BMI - body mass index; EDAS – Eating Disorder Assessment Scale; Preoccupation – Preoccupation with body image and body weight; MPS – Multidimensional Perfectionism Scale; DII – Dickman´s Impulsivity Inventory; DFI – Dysfunctional impulsivity; FI – Functional impulsivity; a - statistically signficant differences from class 1; b - statistically signficant differences from class 2; c - statistically signficant differences from class 3; d - statistically signficant differences from class 4; e - statistically signficantly differences from class 5, * - $p<0.05$; **- $p<0.001$

Table 4. Means, standard deviations and statistics for the comparision between classes on SSP.

Variables	**1.class**	**2.class**	**3.class**	**4.class**	**5.class**	**ANOVA**			**Contrasts**
	M(SD)	**M(SD)**	**M(SD)**	**M(SD)**	**M(SD)**	**$F_{(4,265)}$**	**p**	**η^2**	
SSP scales									
Somatic trait anxiety	58.94 (10.82)^{d**}	54.28 (10.91)$^{(a,c,d,e)**}$	61.17 (10.97)$^{(b,d)**}$	71.17 (7.57)$^{(a,b,c)**}$	63.61 (8.38)^{b**}	14.76	<0.001	0.182	4>1,3,2; 2<3,4,5
Physic trait anxiety	56.34 (10.02)$^{(b,d)**}$	49.31 (9.82)$^{(a,c,d,e)**}$	62.57 (10.75)^{b**}	67.93 (11.81)$^{(a,b)**e*}$	59.67 (8.89)^{b**d*}	27.61	<0.001	0.294	2<1, 3,4,5; 4>1,5
Stress susceptibility	53.31 (9.76)$^{(c,d,e)*}$	49.67 (9.73)$^{(c,d,e)**}$	60.31 (11.99)^{a*b**}	66.08 (10.79)^{a*b**}	61.65 (10.47)^{a*b**}	21.26	<0.001	0.243	1=2<3,4,5
Lack of assertiveness	50.92 (10.63)$^{(c,d)*}$	48.39 (8.29)$^{(c,d)**}$	57.23 (9.72)$^{(a,e)*b**}$	61.82 (10.22)$^{a*(b,e)**}$	50.90 (11.38)^{c*d**}	13.69	<0.001	0.171	3=4>1,2,5
Impulsiveness	51.18 (9.94)	46.64 (11.89)$^{(e,d)*}$	47.23 (10.99)$^{(e,d)*}$	55.21 (12.29)$^{(b,c)*}$	53.90 (8.74)$^{(b,c)*}$	5.10	0.001	0.071	2=3<5; 2<4
Adventure seeking	56.17 (9.77)	52.75 (10.38)	50.07 (10.88)	52.02 (11.94)	52.58 (11.94)	1.42	0.229	0.021	-
Detachment	49.50 (9.05)	45.68 (9.11)$^{(c,d)**e*}$	52.81 (10.51)^{b**}	54.35 (7.06)^{b**}	50.99 (10.19)^{b*}	8.10	<0.001	0.109	2<3,4,5
Social desirability	50.13 (10.34)	47.83 (12.21)	43.05 (11.96)	41.98 (17.94)	42.61 (13.77)	3.15	0.015	0.045	-
Embitterment	57.89 (9.94)$^{(b,d)*}$	50.42 (9.47)$^{a*(c,d,e)**}$	61.81 (12.58)^{b**d*}	71.23 (13.65)$^{(a,b)**c*}$	63.24 (10.59)^{b**}	26.02	<0.001	0.283	2<1,3,4,5; 4>1,3
Trait irritability	51.22 (9.62)$^{(d,e)*}$	51.02 (8.90)$^{(c,d,e)**}$	57.24 (9.11)^{b**}	61.19 (9.65)^{a*b**}	59.75 (9.18)^{a*b**}	12.29	<0.001	0.156	1=2<4,5; 2<3
Mistrust	54.70 (10.11)^{d*}	52.68 (10.41)$^{(c,d)**e*}$	60.76 (9.55)^{b**}	65.94 (9.09)^{a*b**}	59.15 (10.12)^{b*}	11.58	<0.001	0.149	1<4; 2<3,4,5;
Verbal trait agression	53.98 (9.32)	54.34 (8.76)	54.71 (9.98)	58.85 (14.36)	58.54 (9.16)	2.18	0.072	0.032	-
Physical trait agression	51.93 (9.86)	52.15 (8.84)^{e*}	52.79 (10.37)	57.87 (12.97)	57.09 (9.65)^{b*}	3.03	0.018	0.044	2<5

Note: η^2- partial eta squared; SSP – Swedish Universities Scales Scales of Personality;a - statistically signficant differences from class 1; b - statistically signficant differences from class 2; c - statistically signficant differences from class 3; d - statistically signficant differences from class 4; e - statistically signficant differencies from class 5, * - p<0.05; **-p<0.001

Differences in personality traits between classes

Means, standard deviations and statistically significant differences between classes are depicted in Table 4. Statistically significant differences between groups emerged on all SSP scales except on Adventure seeking, Social desirability and Verbal trait aggression. Gabriel´s post hoc was used to confirm where the differences between classes occurred.

Difference in ED symptoms before and after inpatient treatment among latent profiles

Data on the second measurement on EDAS was available for a subsample of 39 ED patients and 25 healthy controls. Mean scores and standard deviations for EDAS total scores and subscales before and after inpatient treatment are presented in Table 5. Only ED patients were included to the analysis (two-way mixed ANOVA).

Table 5. Mean scores and standard deviations on EDAS scale and subscales before and after inpatient treatment.

Variable	**1.class** (n=6)	**2.class** (n=11)	**3.class** (n=9)	**4.class** (n=4)	**5.class** (n=8)
	M(SD)	M(SD)	M(SD)	M(SD)	M(SD)
EDAS total					
I measurement	85.00(11.03)	25.27(14.61)	80.22(22.64)	101.00(19.30)	96.88(17.96)
II measurement	68.33(19.42)	25.63(25.21)	28.67(15.12)*	77.75(10.72)	54.13(31.36)*
Restrained eating					
I measurement	25.67(7.97)	6.18(6.44)	23.78(9.71)	34.50(1.73)	28.11(6.43)
II measurement	22.50(8.87)	5.82(5.17)	10.89(7.39)*	28.50(7.51)	16.22(12.43)*
Binge eating					
I measurement	21.83(7.89)	10.00(6.96)	23.11(14.46)	23.25(17.30)	24.44(9.94)
II measurement	16.67 (8.14)*	8.82(8.16)	6.33(6.00)*	15.75(10.81)	9.89(7.64)*
Purging					
I measurement	11.50(2.35)	0.64(1.21)	3.00(2.12)	10.25(2.50)	17.56(1.88)
II measurement	7.00(3.16)*	2.55(6.01)	0.22(0.44)*	8.00(2.94)*	4.56(6.35)*
Preoccupation					
I measurement	26.00(3.63)	8.45(5.03)	30.33(8.90)	33.00(7.53)	24.00(11.16)
II measurement	22.17(5.71)	8.45(8.04)	11.22(7.48)*	25.50(5.45)	21.25(10.44)

Note: EDAS – Eating Disorders Assessment Scale; Preoccupation – Preoccupation with body image and body weight; *- statistically significant differences ($p<0.05$) from the 1st measurement within the class

Two-way mixed (repeated measures) ANOVA was conducted to examine the effect of time and class membership on EDAS total and subscale scores. The scores in two measurement points are depicted in Figure 2. There was a statistically significant two-way time and class membership (time x class) interaction effect ($F_{(4,33)}$=4.84, p=0.003, η^2=0.375). The effect remained significant (p<0.05) after controlling for possible interactions with days between measurements, BMI and MADRS scores. Simple main effects analysis showed that there was a significant decrease in EDAS scores in classes 3 ($F_{(1,8)}$=21.62, p=0.002, η^2=0.730) and 5 ($F_{(1,7)}$=16.15, p=0.005, η^2=0.698), but there were no differences between measurements in classes 1 (p=0.061), 2 (p=0.852) and 4 (p=0.094).

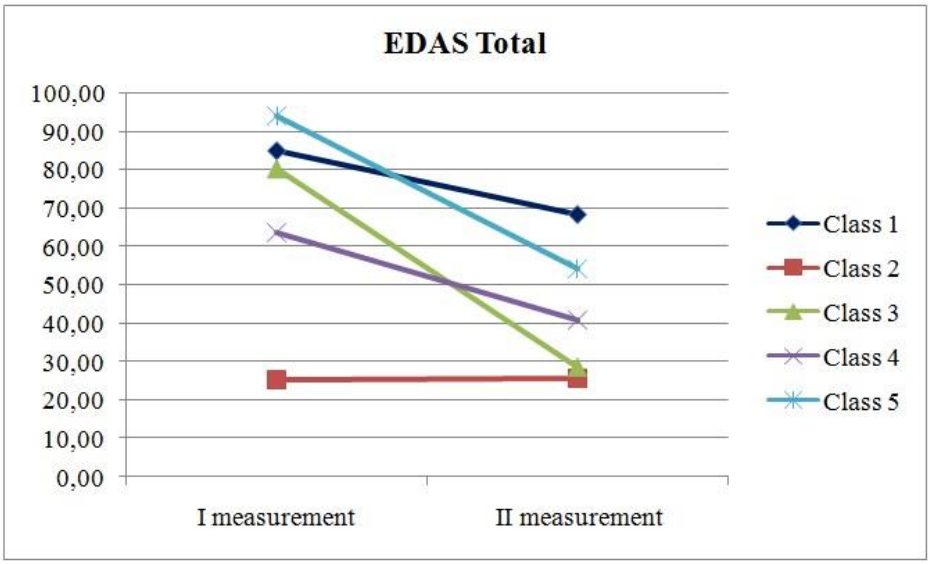

Figure 2. Eating Disorder Assessment Scale (EDAS) total mean scores in five classes on 1st and 2nd measurement.

EDAS subscale scores in two measurement points are depicted in Appendix 2 Figure 1. There was a tendency for time x class interaction effect on Restrained eating ($F_{(4,37)}$=2.55, p=0.057, η^2=0.231). The interaction remained significant (p<0.05) after controlling for days between measurements and BMI, but became insignificant (p=0.068) when MADRS score was added as a covariate in the model, though the interaction with MADRS score was not significant either. Simple main effects analysis showed that there was a significant decrease in Restrained eating scores in classes 3 ($F_{(1,8)}$=5.87, p=0.042, η^2=0.423) and 5 ($F_{(1,7)}$=13.77, p=0.006, η^2=0.633), but there were no differences between measurements in classes 1(p=0.258), 2 (p=0.881) and 4 (p=0.139).

There was also a significant time x class interaction effect on Binge eating scores ($F_{(4,38)}$=2.81, p=0.041, η^2=0.248), which remained significant (p=0.052) after controlling for

days between measurements. The interaction became insignificant ($p>0.05$) when BMI and MADRS scores were added in the model, though the interactions with BMI and MADRS were not significant either. Simple main effects analysis showed that there was a significant decrease in Binge eating scores in classes 1 ($F_{(1,5)}=7.23$, $p=0.043$, $\eta^2=0.591$), 3 ($F_{(1,8)}=8.37$, $p=0.020$, $\eta^2=0.511$) and 5 ($F_{(1,7)}=15.59$, $p=0.041$, $\eta^2=0.568$), but there were no differences between measurements in classes 2 ($p=0.720$) and 4 ($p=0.141$).

This was also the case for Purging, where time x class interaction effect occurred ($F_{(4,38)}=12.78$, $p<0.001$, $\eta^2=0.600$). The interaction remained significant ($p<0.05$), when controlling for BMI and days between measurements, but became non-significant when MADRS score was added to the model ($p=0.096$), though the MADRS and time interaction was not significant either. Simple main effects analysis showed that there was a significant decrease in Purging scores in classes 1 ($F_{(1,5)}=8.05$, $p=0.036$, $\eta^2=0.617$), 3 ($F_{(1,8)}=16.56$, $p=0.004$, $\eta^2=0.674$), 4 ($F_{(1,3)}=12.79$, $p=0.037$, $\eta^2=0.568$) and 5 ($F_{(1,7)}=47.16$, $p<0.001$, $\eta^2=0.855$) and no differences between measurements in class 2 ($p=0.333$).

Time x group interaction ($F_{(4,37)}=5.35$, $p=0.002$, $\eta^2=0.393$) was also significant for the subscale Preoccupation with body image and weight. The effect remained significant ($p<0.05$) after controlling for possible interactions with days between measurements, BMI and MADRS score. Simple main effects analysis showed that there was a significant decrease in Preoccupation with body image and body weight scores only in class 3 ($F_{(1,8)}=24.83$, $p=0.001$, $\eta^2=0.756$), but not in classes 1 ($p=0.135$), 2 ($p=1$), 4 ($p=0.136$) or 5 ($p=0.276$).

Healthy controls (N=25) did not differ between two measurement points on EDAS total score ($p=0.587$), neither on any EDAS subscales.

Discussion

It has been found in several studies that ED patients can be meaningfully classified based on personality features (e.g. Krug et al., 2011; Thompson-Benner et al., 2008; Westen & Harden-Fischer, 2001). One promising way to find more homogenous subgroups of ED patients is to use markers of perfectionism and impulsivity as both of these traits have been associated with disordered eating and are expected to interact while predicting eating disorder symptoms (Bardone-Cone at al., 2007; Waxman 2009). The purpose of the current study was to find latent profiles from a sample of ED patients and healthy controls. The latent profiles (classes)

were based on facets of perfectionism, impulsivity and ED symptoms. The changes in ED symptoms before and after inpatient treatment were also of interest.

Based on the results of our study the five class model was the most parsimonious and best fitting solution. The classes differed significantly from each other on most validation variables and ED and comorbid diagnoses were differently distributed across the classes. As a novel aspect, we found that ED symptoms, assessed before and after inpatient treatment had changed differently in the classes.

The 5-class solution

The hypothesis about at least a four class solution emergence was supported. However, unlike in two previous studies, which included perfectionism and impulsivity dimension in classification analysis of ED patients and where four class solution has been found to be optimal (Boone et al., 2014; Slof-Op't Landt et al., 2016), we found support for the five-class solution. This could be explained by the differences in analysis, as we also included ED symptoms as indicators in the statistical analysis, which makes the classes more diverse by also finding more homogenous disordered eating behavior patterns. This could also be explained by differences in the sample, as we included both healthy controls and ED patients. However, studies which have used a variety of personality traits have also found support for the five class model (e.g Thompson-Brenner et al., 2008a), and proposed the following classes 1) high-functioning 2) behaviorally dysregulated 3) emotionally dysregulated 4) avoidant-insecure 5) obsessional-sensitive.

The hypothesis about classes resembling the three class solution was also supported as the emerged classes revealed important similarities with undercontrolled, overcontrolled and resilient/high-functioning classes (e.g. Westen & Harden-Fischer, 2001; Wonderlich et al., 2005). The 1st class could be identified as the resilient, the 3rd as the overcontrolled and 4th and 5th as undercontrolled. This finding again confirms the robust existence of three main subtypes of ED patients.

Emerged classes and their characteristics

As hypothesized, classes differed significantly on ED symptoms, personality variables and frequency of ED and comorbid diagnoses.

Class 1 could be characterized by low perfectionism and moderate dysfunctional impulsivity, so it resembles the „resilient" class. The main differences between the 1st and 2nd class could

be described as differences in symptom severity rather than qualitative differences, as reflected by similarly low levels of adaptive and maladaptive perfectionism and high levels of functional impulsivity. The differences in severity have also been found in previous studies (Jacobs et al., 2009). This finding again embraces the dimensional nature of eating disorders and usefulness of specifying severity, as it may reveal important descriptive and prognostic information. Class 1 had lower perfectionism scores, stress susceptibility, trait irritability and preoccupation with body image and body weight compared to classes 4 and 5. So impulsivity itself can be associated with some disordered eating symptoms, but the severity of those symptoms is also influenced by the interplay between impulsivity and other personality traits.

Class 2 could be named as a „healthy" class as it was characterized by the lowest level of ED symptoms, perfectionism, and dysfunctional impulsivity, but the highest functional impulsivity. This class also had the lowest scores on almost all SSP subscales. Though most of the individuals belonging to this class were healthy controls, there was still a substantial amount of patients with AN-R. This rather unexpected finding is in concordance with Krug et al. (2011), who also found that a high amount of individuals with restrictive symptoms belonged in the „adaptive" profile. It has been proposed that these patients are in denial of their symptoms, as it has been found that underweight EDNOS patients are denying their psychopathology (Eddy et al., 2009). This may also imply that these patients do not actually want treatment, confirming the egosyntonic nature of AN (Marzola, Abbate-Daga, Gramaglia, Amianto, & Fassino, 2015; Nordbo, Espeset, Gulliksen, Skårderud, & Holte, 2006) and they are rather brought to treatment as someone else is concerned about their weight (Wasten & Hardnen-Fischer, 2001). On the other hand, it may also mean that these patients really have lower levels of distress and ED symptoms as found previously (Eddy et al., 2009). Future studies should make efforts to investigate what factors are maintaining ED pathology in this seemingly healthy class.

Class 3 could be named „restrictive". Individuals in this class had moderately high perfectionism scores on all perfectionism scales and low dysfunctional and functional impulsivity, resembling pure perfectionism (Boone et al., 2014) or healthy and unhealthy perfectionism class (Slof-Op't Landt et al., 2016) in previous studies. This class had also higher levels of lack of assertiveness, stress susceptibility, physic and somatic trait anxiety, detachment, embitterment, irritability, and mistrust than class 2. This class had higher disordered eating scores on scales Restrained eating and Preoccupation with body image and body weight compared to Binge eating and Purging confirming our hypothesis about

overcontrolled class being mostly characterized by restrained eating symptoms. Not surprisingly, most of the patients belonging to this class had AN-R, but interestingly significantly more patients with BED belonged to this class, supporting the theory that restrained eating may be the mediating factor between perfectionism and binge eating (Forbush et al., 2007; Sherry & Hall, 2009).

Class 4 resembles the „emotionally dysregulated" class, as found in Thompson-Brenner et al. (2008a) study. Individuals in this class had the highest perfectionism scores, especially high scores on negative perfectionism dimensions Concern over mistakes and Parental criticism and the lowest functional and high dysfunctional impulsivity. In addition, this class had the highest OCI-R scores, indicating the compulsive nature of the class, and the associations between perfectionism and compulsivity.This finding confirms the findings that impulsive and compulsive tendencies can be elevated in the same individual (Claes et al., 2002). In regards to disordered eating behavior, this class had the highest scores in Preoccupation with body image and body weight and Restrained eating, but lower scores in Binge eating and Purging than class 5. Most patients belonging to this class had BN and there were also significantly more individuals with BED diagnosis in this class than in other classes. They had the highest percentage of anxiety and mood disorders, which is also in line with the result that they also exhibit high physic and somatic trait anxiety, stress susceptibility, detachment, embitterment, irritability, impulsiveness, lack of assertiveness and mistrust. It may be that individuals in this class do not have adaptive ways to cope with anxiety and in order to cope with high standards and impulsivity, they use disordered eating behaviors to regulate their mood and anxiety. BED patients belonging to this class also supports this idea, as it has been found strong associations between emotion regulation difficulties and BED (Aldao, Nolen-Hoeksema, & Schweizer, 2010; Haedt-Matt & Keel, 2011), though emotion regulation difficulties have also been associated with other ED diagnoses (Brockmeyer et al., 2014).

Class 5 could be characterized by moderate perfectionism and high dysfunctional impulsivity. It could be named as the „behaviorally dysregulated" class, as also reported by Thompson-Brenner et al. (2008a). Members of the 5th class had the highest levels of Purging as well as the highest total score on EDAS. Most of the patients belonging to this class were diagnosed with BN and comorbid substance abuse disorder was frequent. The result is in concordance with Thompson-Brenner et al. (2008b) reporting that behaviorally dysregulated class was characterized by multiple forms of impulsivity, showing specific vulnerability to alcohol or drug abuse (compared to other classes, including emotionally dysregulated). This indicates

that individuals in this class have problems with controlling their behavior and they use more compensatory behaviors (like purging).

In regards to perfectionism subscales, it seems that Organization is not a good subscale for differentiating between ED patients or healthy controls, neither between latent classes or ED diagnoses. So it could be identified as the healthy part of perfectionism. Personal standards, on the other hand, which has previously also been handled as an adaptive dimension (Lo & Abbott, 2013), was significantly higher in AN-R and BN patients and also differentiated the latent classes. Thus in relation to ED, our results are in line with previous findings reporting that both Personal standards and Concern over mistakes are associated with disordered eating behavior (for and overview see Bardone-Cone et al., 2007).

The emerging of both high perfectionism and high impulsivity class is in line with Boone et al. (2014) study. Though we found two combined classes, emotionally and behaviorally dysregulated, it confirms the finding that both overcontrolling and undercontrolling traits can characterize ED patients (Claes et al., 2002). As the duration of disorder was longer in classes 4 and 5 than classes 2 or 3 it might indicate that some individuals might have crossed over from other classes to those combined classes, as it has been found that many patients with AN develop episodes of binge eating and loss of control over time (Peat et al., 2009). Boone et al. (2014) have discussed that maybe these individuals have developed high levels of restrained eating in order to control their impulsivity, but over time this strategy fails.

In contrast to studies, which have not found differences in ED symptoms between undercontrolled and overcontrolled classes (Claes et al., 2006; Lavender et al., 2013), we found that dysregulated classes scored higher on EDAS than restricting or healthy class. There were no differences between overcontrolled and undercontrolled classes on restrained eating subscales. This is in line with previous studies, which have found that both overcontrolled and undercontrolled individuals score equally high on restrained eating (Claes et al., 2010).The differences between classes emerged in purging, which as an impulsive behavior, seems to differentiate between overcontrolled and undercontrolled individuals. It may be that most of the ED patients are at first trying to restrain their eating and are preoccupied with thoughts about their body weight and shape, but their strategies for regulating their weight are different, impulsive people showing more compensatory behaviors, as they may not be that successful in restraining their eating.

Changes in ED symptoms before and after inpatient treatment

Another purpose of the study was to investigate changes in ED symptoms before and after inpatient treatment in emerged classes. As hypothesized, we found a significant time and class membership interaction effect for all EDAS subscales. The restrictive (class 3) and behaviorally dysregulated (class 5) classes had significant reductions in ED symptoms like restricting, binging and purging but only in the restrictive class, there was a decrease in Preoccupation with body image and body weight subscale, indicating changes in cognitive symptoms of ED. The most notable changes in the behaviorally dysregulated class emerged in purging and binging. There was also a tendency for a decrease in ED symptoms in the resilient class (class 1), but this did not reach statistical significance.

Although perfectionism has been found to complicate treatment (Egan & Wade, 2011) the restrictive class, which had large differences in all of the EDAS subscales, was indeed characterized by heightened perfectionism. It is possible that the third class may be the „good patients" in treatment who try hard and have better adherence to treatment. For example, it has been found that conscientiousness (which is associated with perfectionism) showed a significant association with medication compliance (Stilley, Sereika, Muldoon, Ryan, & Dunbar-Jacob, 2004), so maybe this could also be generalized to overall compliance to treatment. Also, the restrictive class had shorter duration of ED, which has been found to be associated with better outcome in treatment (Vall & Wade, 2015). The controlled environment in inpatient treatment helps to establish behavioral changes, but as the restrictive class had also changes in cognitive aspects of ED, there might be something differentiating this class from others, which helps them to establish those changes. Moderate perfectionism levels and successfully maintaining restrained eating indicates that this class has good self-control, which gives them an advantage in regulating their behavior. The exact mechanism has yet to be investigated.

The result that the emotionally dysregulated class (class 4) did not have statistically significant changes in EDAS total score is in line with previous studies, where it has been found that individuals in undercontrolled class had less successful response to treatment, more serious course of ED relative to patients in overcontrolled or resilient class, and required a longer duration of treatment to achieve remission (Thompson-Brenner & Westen, 2005; Wildes et al., 2011). It is interesting, that the behaviorally dysregulated class, which also resembles an undercontrolled class, had significant behavioral changes in ED symptoms. It may be that emotional, not behavioral dysregulation, is specifically complicating treatment as

it is easier to change behavior than emotional dysregulation. Emotion regulation difficulties have been found to be associated with treatment outcome before (Rowsell, MacDonald,& Carter, 2016), but our finding clearly brings out the importance of distinguishing between emotionally and behaviorally dysregulated individuals. It is important to pay attention to the result that emotionally dysregulated class also had the highest anxiety, which may hinder treatment, as it has been found that comorbid psychopathology is associated with poorer treatment outcome (Vall & Wade, 2015).

The emotionally dysregulated class had both high perfectionism and impulsivity and as in previous studies, both of these traits have been found to be related to poorer treatment outcome (Egan & Wade, 2011; Waxman, 2009). These results suggest that perfectionism alone might not be a complicating factor in ED treatment, but a combination of high perfectionism and impulsivity is aggravating for treatment response.

It is surprising that level of disordered eating behavior did not change in the second class and (though not statistically significantly) levels of purging were even higher at the end of inpatient treatment. This change could be due to increase in illness awareness during inpatient treatment and more adequate reporting of symptoms, confirming the theory that patients in this class may at first underreport their ED symptoms. In previous studies, it has been found that though low psychopathology group had the best results after short-term treatment, they had very high readmission rate (Wildes et al., 2011), which again may indicate that members of this class are underreporting their symptoms. In the future, it would be interesting to examine if there are any differences in long-term changes in ED symptoms, as it has been proposed that long-term and short-term treatment may be influenced by different factors (Wildes et al., 2011).

Limitations

The current study has several limitations. First, our study was cross-sectional so no causal interpretations can be made with full confidence. Though there is strong evidence about personality traits being risk factors for eating disorders, there is also a possibility that the disorder itself influences personality, cognition and impulsive behavior (Farstad et al., 2016). Further research efforts are needed to study profiles longitudinally to investigate the stability of profiles, to see if individuals fluctuate or cross-over between profiles over time and if there are any changes in perfectionism or impulsivity over time and how those changes influence ED symptoms.

Also, as we used self-report scales as measures, we can not rule out that patients underestimate, or overestimate their symptoms. Impulsivity can also be examined experimentally and behaviourally and it would be interesting to see if the profiles would be different when using other ways to measure impulsivity.

The data for the second measurement was only available for a smaller subsample, so the results should be interpreted with caution. But as the results with low power in our analysis gave promising differences in symptom changes, it would be a theme worth further investigations.

Implications and future directions

The results of our study have important implications for both ED research and treatment planning. Identifying individuals who can obtain the greatest benefit from inpatient treatment or on the opposite, who fail to respond to treatment, could help to make the first steps towards ensuring that those patients also get the suitable follow-up intervention after inpatient treatment (Vall & Wade, 2015). This also indicates that interventions need to be planned differently for patients, depending on their levels of perfectionism and impulsivity. For example, as found in our study, that emotionally dysregulated class showed the fewest changes in ED symptoms, it may be valuable to include emotion regulation skill training to their treatment after behavior modification. But on the other hand, the controlled environment in inpatient settings seems to suit well for more restrictive type or behaviorally dysregulated patients.

Future studies would benefit from combining psychological and biological markers when examining profiles of ED patients. Moving towards more dimensional classification of psychiatric disorders, including ED, is important as at the moment patients with the same diagnosis can have substantial differences in symptoms or even seemingly opposite symptoms and on the other hand, patients with distinct disorders can share several symptoms (Robbins, Gillan, Smith, de Wit, & Ersche, 2012). Though DSM-5 has improvements like rating symptom severity, it still lacks biological basis. Robbins et al. (2012) have proposed to use impulsivity and compulsivity as transdiagnostic features to investigate possible similarities and also differences between disorders. For example, there have been found behavioral similarities (e.g. loss of control, craving) between substance abuse and eating disorders, like BED and BN, which may indicate similar underlying neurocognitive mechanisms

(impulsivity and compulsivity). The interplay between perfectionism and impulsivity may also indicate the both compulsive and impulsive nature of eating disorders.

Conclusions

Theoretically and clinically meaningful classes could be identified based on facets of perfectionism, impulsivity and eating disorder symptoms. We complemented the literature on personality based classification, but as a novel aspect, we found that personality based classes could provide important information for treatment planning. Our study provides valuable knowledge for the development of dimensional classifications system of ED and treatment research. In clinical practice, this knowledge can provide additional information for tailoring treatment plans for patients as it important to consider patients personality functioning and comorbid psychopathology in addition to eating disorder symptoms.

References

Akaike, H. (1987). Factor analysis and AIC. *Psychometrika, 52*, 317–332.

Akkermann, K., Herik, M., Aluoja, A., & Järv, A. (2010). Constructing an assessment scalefor eating disorders. Department of Psychology, University of Tartu.

Aldao, A., Nolen-Hoeksema, S., & Schweizer, S. (2010). Emotion-regulation strategiesacross psychopathology: A meta-analytic review. *Clinical Psychology Review, 30*(2),217-237.

Altman, S.E. & Shankman, S.A. (2009). What is the association between obsessive-compulsive disorder and eating disorders? *Clinical Psychology Review, 29*, 638-646.

Anestis, M.D., Selby, E.A. & Joiner. T.E. (2007). The role of urgency in maladaptive behaviors. *Behavior Research and Therapy, 45*(12), 3018-29.

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders: DSM-IV-TR.* Washington, DC: American Psychatric Association.

American Psychiatric Association (APA) (2013). *The diagnostic and statistical manual of mental disorders, fifth edition: DSM 5*. Arlington, VA:American Psychatric Association

Bardone-Cone, A., Butler, R., Balk, M., & Koller, K. (2016). Dimensions of impulsivity in relation to eating disorder recovery. *International Journal Of Eating Disorders, 49*(11), 1027-1031.

Bardone-Cone, A. M., Wonderlich, S. A., Frost, R. O., Bulik, C. M., Mitchell, J. E., Uppala, S., & Simonich, H. (2007). Review article: Perfectionism and eating disorders: Current status and future directions. *Clinical Psychology Review, 27,* 384-405.

Beck, I.,Smits, D.J., Claes, L., Vandereycken, W., & Bijttebier, P. (2009). Psychometric evaluation of the behavioral inhibition/behavioral activation system scales and the

sensitivity to punishment and sensitivity to reward questionnaire in a sample of eating disordered patients. *Personality and Individual Differences, 47*(5), 407−412.

Berlin, K.S., Williams, N.A., & Parra, G.R. (2014). An introduction to latent variable mixture modeling (Part 1): Overview and cross-sectional Latent Class and Latent Profile Analysis. *Journal of Pediactric Psychology, 39,* 174-187.

Black, E.B.& Mildred, H. (2014). A cross-sectional examination of non-suicidal self-injury, disordered eating, impulsivity, and compulsivity in a sample of adult women. *Eating Behaviors, 15(4),* 578-581.

Boisseau, C. L., Thompson-Brenner, H., Caldwell-Harris, C., Pratt, E., Farchione, T., & Harrison Barlow, D. (2012). Behavioral and cognitive impulsivity in obsessive–compulsive disorder and eating disorders. *Psychiatry Research, 200*(2-3), 1062-1066.

Boisseau, C. L., Thompson-Brenner, H., Eddy, K. T., & Satir, D. A. (2009). Impulsivity and Personality Variables in Adolescents with Eating Disorders. *The Journal of Nervous and Mental Disease, 197*(4), 251–259.

Boisseau, C. L., Thompson-Brenner, H., Pratt, E. M., Farchione, T. J., & Barlow, D. H. (2013). The relationship between decision-making and perfectionism in obsessive–compulsive disorder and eating disorders. *Journal of Behavior Therapy and ExperimentalPsychiatry, 44*, 316–321.

Boone, L., Claes, L., & Luyten, P. (2014). Too strict or too loose? Perfectionism and impulsicity: The relation with eating disorder symptoms using a person-centered approach. *Eating Behaviors, 15*, 17-23.

Boone, L., Soenens, B., Caroline, B. & Goossens, L. (2010). An empirical typology of perfectionism in early-to-mid adolescents and its relation with eating disorder symptoms. *Behaviour Research and Therapy, 48*(7), 686-691.

Brockmeyer, T., Skunde, M., Wu, M., Bresslein, E., Rudofsky, G., Herzog, W., & Friederich, H. (2014). Difficulties in emotion regulation across the spectrum of eating disorders. *Comprehensive Psychiatry, 55,* 565-571.

Cassin, S.E. &von Ranson, K.M. (2005). Personality and eating disorders: a decade in review. *Clinical Psychology Review, 25*, 895−916.

Claes, L., Islam, M. A., Fagundo, A. B., Jimenez-Murcia, S., Granero, R., Agüera, Z., ...Fernández-Aranda, F. (2015). The relationship between non-suicidal self-injury andthe UPPS-P impulsivity facets in eating disorders and healthy controls. *PloS One, 10*.

Claes, L., Robinson, M.D., Muehlenkamp, J. J., Vandereycken, W., & Bijttebier, P. (2010). Differentiating bingeing/purging and restrictive eating disorder subtypes: The roles of temperament, effortful control, and cognitive control. *Personality and IndividualDifferences, 48*, 166−170.

Claes, L., Vandereycken, W., Luyten, P., Soenens, B., Pieters, G., & Vertommen, H. (2006). Personality prototypes in eating disorders based on the Big Five model. *Journal ofPersonality Disorders, 20*, 401–416.

Claes, L., Vandereycken, W., & Vertommen, H. (2002). Impulsive and compulsive traits in eating disordered patients compared with controls. *Personality And Individual Differences, 32*(4), 707-714.

Claes, L., Vandereycken, W., & Vertommen, H. (2005). Impulsivity-related traits in eating disorder patients. *Personality And Individual Differences, 39*, 739-749.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). New York, NY: Psychology Press

Culbert, K. M., Racine, S. E., & Klump, K. L. (2015). Research review: What we have learned about the causes of eating disorders—A synthesis of sociocultural, psychological, and biological research. *Journal Of Child Psychology And Psychiatry, 56*(11), 1141-1164.

Dickman, S. J. (1990). Functional and dysfunctional impulsivity: Personality and cognitive correlates. *Journal of Personality and Social Psychology*, *58*(1), 95-102.

Eddy, K. T., Dorer, D. J., Franko, D. L., Tahilani, K., Thompson-Brenner, H., & Herzog, D. B. (2008). Diagnostic Crossover in Anorexia Nervosa and Bulimia Nervosa: Implications for DSM-V. *The American Journal of Psychiatry, 165*(2), 245–250.

Eddy, K.T., Crosby, R.D., Keel, P.K., Wonderlich, S.A., le Grange, D., Hill, P., Powers, P., &Mitchell, J.E. (2009). Empirical identification and validation of eating disorder phenotypes in a multisite clinical sample. *The Journal of Nervous and Mental Disorders, 197*, 41–49.

Egan, S. J., Wade, T. D., & Shafran, R. (2011). Perfectionism as a transdiagnostic process: A clinical review. *Clinical Psychology Review*, *31*(2), 203-212.

Engel, S., Corneliussen, S., Wonderlich, S., Crosby, R., le Grange, D., Crow, S., & ... Steiger, H. (2005). Impulsivity and compulsivity in bulimia nervosa. *International Journal Of Eating Disorders*, *38*(3), 244-251.

Farstad, S.M., McGeown, L.M., & von Ranson, K.M. (2016). Eating disorders and personality, 2004-2016: A systematic review and meta-analysis. *Clinical Psychology Review, 46*, 91-105.

Fassino, S., Amianto, F., Gramaglia, C., Facchini, F., & Abbate-Daga, G. (2004). Temperament and character in eating disorders: ten years of studies. *Eating and Weight Disorders, 9*, 81–90.

Favaro, A., Zanetti, T., Tenconi, E., Degortes, D., Ronzan, A., Veronese, A., & Santonastaso, P. (2005). The Relationship Between Temperament and Impulsive Behaviors in Eating Disordered Subjects. *Eating Disorders*, *13*(1), 61-70.

First, M.B., Spitzer, R.L, Gibbon, M., & Williams, J. B.W. (2002). *Structured Clinical Interview for DSM-IV-TR Axis I Disorders, Research Version, Patient Edition.* (SCID-I/P) New York: Biometrics Research, New York State Psychiatric Institute.

Fischer, S., Peterson, C.M., McCarthy, D. (2013). A prospective test of the influence of negative urgency and expectancies on binge eating and purging.*Psychology of Addictive Behaviors, 27* (1), 294-300.

Fischer, S., Smith, G.T., & Cyders, M.A. (2008). Another look at impulsivity: A metaanalytic review comparing specific dispositions to rash action in their relationship to bulimic symptoms. *Clinical Psychology Review, 28*, 1413–1425.

Frost, R. O., Marten, P., Lahart, C., & Rosenblate, R. (1990). The dimensions of perfectionism. *Cognitive Therapy and Research, 14*, 449 – 468.

Foa, E. B., Kozak, M. J., Salkovskis, P. M., Coles, M. E., & Amir, N. (1998). The validation of a new obsessive–compulsive disorder scale: The Obsessive–Compulsive Inventory. *Psychological Assessment, 10*(3), 206-214.

Foa, E. B., Huppert, J. D., Leiberg, S., Langner, R., Kichic, R., Hajcak, G., & Salkovskis, P. M. (2002). The Obsessive-Compulsive Inventory: Development and validation of a short version. *Psychological Assessment*, *14*(4), 485-496.

Forbush, K., Heatherton, T. F., & Keel, P. K. (2007). Relationships between perfectionism and specific disordered eating behaviors. *International Journal Of Eating Disorders*, *40*(1), 37-41.

Gibson, W. A. (1959). Three multivariate models: Factor analysis, latent structure analysis, and latent profile analysis. *Psychometrika*, *24*, 229-252.

Haedt-Matt, A.A. & Keel, P. K. (2011). Revisiting the Affect Regulation Model of BingeEating: A Meta-Analysis of Studies Using Ecological Momentary Assessment.*Psychological Bulletin*. 137 (4), 660–681.

Hilbert, A., Pike, K. M., Goldschmidt, A. B., Wilfley, D. E., Fairburn, C. G., Dohm, F. -A., ... Striegel Weissman, R. (2014). Risk factors across the eating disorders. *PsychiatryResearch, 220,* 500–506.

Holliday, J., Landau, S., Collier, D., & Treasure, J. (2005). Do illness characteristics and familial risk differ between women with anorexia nervosa grouped on the basis of personality pathology? *Psycholological Medicine, 36*(4), 529–538.

Insel, T., Cuthbert, B., Garvey, M., Heinssen, R., Pine, D. S., Quinn, K., et al. (2010). Research domain criteria (RDoC): toward a new classification framework for research on mental disorders. *American Journal of Psychiatry, 167(7),* 748–751.

Jacobs, M. J., Roesch, S., Wonderlich, S. A., Crosby, R., Thornton, L., Wilfley, D. E., … Bulika, C. M. (2009). Anorexia nervosa trios: behavioral profiles of individuals with anorexia nervosa and their parents. *Psychological Medicine, 39*, 451-461.

Keel, P. K.,Brown, T.A., Holland, L. A., & Bodell, L. P. (2012). Empirical classification of eatingdisorders. *Annual Review of Clinical Psychology, 8*, 381–404.

Keel, P. & Michell, J.E. (1997). Outcome in bulimia nervosa. *American Journal of Psychiatry, 154*, 313–321.

Klump, K. L., Bulik, C. M., Kaye, W. H., Treasure, J., & Tyson, E. (2009). Academy for eating disorders position paper: Eating disorders are serious mental illnesses. *International Journal Of Eating Disorders*, *42*(2), 97-103.

Krug, I., Root, T., Bulik, C., Granero, R., Penelo, E., Jimenez-Murcia, S., & Fernandez-Aranda, F. (2011). Redefining phenotypes in eating disorders based on personality: A latent profile analysis. *Psychiatry Research, 188*(3),439–445.

Krueger, R., & Eaton, N. (2010). Personality traits and the classification of mental disorders: Toward a more complete integration in DSM-5 and an empirical model of psychopathology. *Personality Disorders: Theory, Research, And Treatment*, *1*(2), 97-118.

Krueger, R. F., Watson, D., & Barlow, D. H. (2005). Introduction to the special section: Toward a dimensionally based taxonomy of psychopathology. *Journal of Abnormal Psychology*, *114*(4), 491–493.

Kuppart, K. (2005). Dickman´s Impulsivity Inventory psychometric characteristics and associations with five factor model. Research paper. Institute of Psychology, University of Tartu.

Lanza, S. T., Tan, X., & Bray, B. C. (2013). Latent Class Analysis With Distal Outcomes: A Flexible Model-Based Approach. *Structural Equation Modeling : A Multidisciplinary Journal*, *20*(1), 1–26.

Lavender, J. M., Wonderlich, S. A., Crosby, R. D., Engel, S. G., Mitchell, J. E., Crow, S. J., ... Le Grange, D. (2013). Personality-based subtypes of anorexia nervosa: examining validity and utility using baseline clinical variables and ecological momentary assessment. *Behaviour Research And Therapy*, *51*(8), 512-517.

Lichtenstein, M. B., Hinze, C. J., Emborg, B., Thomsen, F., & Hemmingsen, S. D. (2017). Compulsive exercise: links, risks and challenges facedent. *Psychology Research and Behavior Management*, *10*, 85–95.

Lilenfeld, L., Wonderlich, S., Riso, L., Crosby, R., & Mitchell, J. (n.d). Eating disorders and personality: A methodological and empirical review. *Clinical Psychology Review*, *26*(3), 299-320.

Lo, A., & Abbott, M. J. (2013). Review of the theoretical, empirical, and clinical status of adaptive and maladaptive perfectionism.*Behaviour Change*, *30*(2), 96-116.

Lo, Y., Mendell, N., & Rubin, D. (2001). Testing thenumber of components in a normal mixture. *Biometrika, 88,* 767–778.

Lundahl, A., Wahlstrom, L. C., Christ, C. C., & Stoltenberg, S. F. (2015). Gender differences in the relationship between impulsivity and disordered eating behaviors and attitudes. *Eating Behaviors, 18,* 120-124.

Marzola, E., Abbate-Daga, G., Gramaglia, C., Amianto, F.,& Fassino, S. (2015). A qualitative investigation into anorexia nervosa: The inner perspective. *Cogent Psychology*, *2*(1).

McLachlan, G., & Peel, D. (2000). *Finite mixture models*.New York, NY: Wiley.

Muthén, L.K. &Muthén, B.O. (1998-2010). Mplus User's Guide. Sixth Edition. Los Angeles, CA: Muthén & Muthén

National Institite of Mental Health. National Institute of Mental Health strategic plan. NIMH Publication No. 08-6368. 2008 Retrieved from: http://www.nimh.nih.gov/about/strategic-planning-reports/nimh-strategic-plan-2008

Nordbø, R. S., Espeset, E. S., Gulliksen, K. S., Skårderud, F., & Holte, A. (2006). The Meaning of Self-Starvation: Qualitative Study of Patients' Perception of Anorexia Nervosa. *International Journal Of Eating Disorders*, *39*(7), 556-564.

Oberski, D. L. (2016). Mixture models: latent profile and latent class analysis. In Robertson, J., & Kaptein, M. (Eds.), In *Modern statistical methods for HCI: a modern look at data analysis for HCI research*. Switzerland: Springer.

Patton J. H., Stanford M. S.,& Barratt E. S. (1995). Factor structure of the Barratt Impulsiveness Scale. J. Clin. Psychol. 51, 768–774.

Pearson, C.A. & Gleaves, D.H. (2006). The multiple dimensions of perfectionism and their relation with eating disorder features. *Personality and Individual Differences. 41*(2), 225-235.

Peat, C., Mitchell, J. E., Hoek, H., & Wonderlich, S. (2009). Validity and Utility of Subtyping Anorexia Nervosa. *The International Journal of Eating Disorders, 42*(7), 590–594.

Pinto, A., Dargani, N., Wheaton, M. G., Cervoni, C., Rees, C. S., & Egan, S. J. (2017). Perfectionism in obsessive-compulsive disorder and related disorders: What should treating clinicians know?. *Journal Of Obsessive-Compulsive & Related Disorders, 12,* 102-108.

Quick, V.M., Byrd-Bredbenner, C.,& Neumark-Sztainer, D. (2013). Chronic illness and disordered eating: A discussion of the literature. *Advances of Nutrition, 4*(3), 277-286.

Ram, N., & Grimm, K. J. (2009). Growth Mixture Modeling: A Method for Identifying Differences in Longitudinal Change Among Unobserved Groups. *International Journal of Behavioral Development, 33*(6), 565–576.

Rice, K. G. & Preusser, K. J. (2002). The Adaptive/Maladaptive Perfectionism Scale. *Measurement & Evaluation in Counseling & Development, 34,* 35-48.

Robbins, T.W., Gillan, C.M., Smith, D.G., de Wit, S., Ersche, K.D. (2012). Neurocognitive endophenotypes of impulsivity and compulsivity: towards dimensional psychiatry. *Trends in Cognitive Sciences, 16*(1), 81-91.

Rowsell, M., MacDonald, D. E., & Carter, J. C. (2016). Emotion regulation difficulties in anorexia nervosa: associations with improvements in eating psychopathology. *Journal of Eating Disorders, 4,* 17.

Saarniit, M. (1999). Constructing of the Estonian version of Multidimensional Perfectionism Scale. Research Paper. Institute of Psychology, University of Tartu.

Sclove, L. (1987). Application of model-selection criteria tosome problems in multivariate analysis. *Psychometrika, 52*, 333–343.

Schwartz, G. (1978). Estimating the dimension of amodel. *The Annals of Statistics, 6,* 461-464.

Shafran, R., Cooper, Z. & Fairburn, C. G. (2002). Clinical perfectionism: A cognitive-behavioural analysis. *Behaviour Research and Therapy, 40,* 773– 791.

Sheehan, D.V., Lecrubier, Y., Sheehan, K.H., & Amorim, P. (1994) *The Mini-International Neuropsychiatric Interview (M.I.N.I): the development and validation of a structured diagnostic psychiatric interview for DSM-IV and ICD-10.* University of South Florida College of Medicine, Tampa, USA.

Sherry, S.B. &Hall, P.A. (2009). The perfectionism model of binge eating: Tests of an integrative model. *Journal of Personality and Social Psychology, 96*, 690–709.

Shlik, J., Aluoja, A., Graf, L. & Männik (2001). Swedish University Scales of Personality, Estonian version.

Shlik, J., Aluoja, A.,& Kihl, E. (1999) MINI 5.0.0 Mini international neuropsychiatric intreview. DSM-IV, Estonian version.

Slof-Op't Landt, M.C.T., van Furth, E.F., & Claes, L. (2016). Classifying eating disorders based on "healthy" and "unhealthy" perfectionism and impulsivity. *International Journal Of Eating Disorders, 49*(7), 673-680.

Smink, F.R., van Hoeken, D.,& Hoek. H.W. (2012).Epidemiology of eating disorders: incidence, prevalence and mortality rates.*Current Psychiatry Reports, 14*(4), 406-14.

Soenens, B., Vansteenkiste, M., Vandereycken, W., Luyten, P., Sierens, E., & Goossens, L.(2008). Perceived parental psychological control and eating-disordered symptoms —Maladaptive perfectionism as a possible intervening variable. *Journal of Nervous and Mental Disease, 196*, 144–152.

Stilley, C. S., Sereika, S., Muldoon, M. F., Ryan, C. M., & Dunbar-Jacob, J. (2004). Psychological and Cognitive Function: Predictors of Adherence With Cholesterol Lowering Treatment. *Annals Of Behavioral Medicine, 27*(2), 117-124.

Stoeber, J. & Otto, K. (2006). Positive conceptions of perfectionism: Approaches, evidence, challenges. *Personality and Social Psychology Review, 10*(4), 295-319.

Svanborg, P., & Åsberg, M. A. (1994) A new self-rating scale for depression and anxiety states based on the Comprehensive Psychopathological Rating Scale. *Acta Psychiatrica Scandinavica, 89,* 21-28.

Säde, K. (2016). Adaption of the Estonian version of OCI-R. Research paper. Department of Psychology, University of Tartu.

Tein, J.-Y., Coxe, S., & Cham, H. (2013). Statistical power to detect the correct number of classes in latent profile analysis. *Structural Equation Modeling : A Multidisciplinary Journal*, *20*(4), 640–657.

Thompson-Brenner, H., Eddy, K., Dorer, D., Franko, D., Vashchenko, M., & Herzog, D. (2008a). A personality classification system for eating disorders: A longitudinal study. *Comperhensive Psychiatry*, *49*, 551-560.

Thompson-Brenner, H., Eddy, K.T., Franko, D.L., Dorer, D., Vashchenko, M.,& Herzog, D. (2008b). Personality pathology and substance abuse in eating disorders: A longitudinal study. *International Journal of Eating Disorders, 41,* 203-208.

Thompson-Brenner, H., Eddy, K.T., Satir, D.A., Boisseau, C.L., & Westen, D. (2008c). Personality subtypes in adolescents with eating disorders: validation of a classification approach. *Journal of Child Psychology and Psychiatry, 49,* 170-180.

Thompson-Brenner, H.,& Westen, D. (2005). Personality subtypes in eating disorders: Validation of a classification in a naturalistic sample. *British Journal of Psychiatry, 186,* 516-524.

Turner, B. J., Claes, L., Wilderjans, T. F., Pauwels, E., Dierckx, E., Chapman, A. L., & Schoevaerts, K. (2014). Personality profiles in Eating Disorders: Further evidence of the clinical utility of examining subtypes based on temperament. *Psychiatry Research*, *219*157-165.

Vall, E.& Wade, T.D. (2015). Predictors of treatment outcome in individuals with eating disorders: A systematic review and meta-analysis. *International Journal of Eating Disorders, 48*(7), 946-971

Vermunt, J. K., & Magidson, J. (2002). Latent class cluster analysis. In J. A. Hagenaars & A. L. McCutcheon (Eds.), Applied latent class analysis (lk 89–106). Cambridge, UK: Cambridge University Press.

Wade, T. D., Tiggemann, M., Bulik, C.M., Fairburn, C. G.,Wray, N. R., &Martin, N. G. (2008).Shared temperament risk' factors for anorexia nervosa: A twin study. *PsychosomaticMedicine, 70,* 239–244.

Waxman, S. E. (2009). A systematic review of impulsivity in eating disorders. European Eating Disorders Review, 17(6), 408-425.

Westen, D., & Harnden-Fischer, J. (2001). Personality profiles in eating disorders: Rethinking the distinction between axis I and axis II. American Journal of Psychiatry, 158, 547–562.

Westen, D.& Muderrisoglu, S. (2006). Clinical assessment of pathological personality traits. *American Journal of Psychiatry, 163,* 1285–1287.

Widiger, T. A., & Samuel, D. B. (2005). Diagnostic categories or dimensions? A question forthe Diagnostic and Statistical Manual of Mental Disorders—fifth edition. *Journal of Abnormal Psychology*, *114*(4), 494–504.

Whiteside S. P.& Lynam D. R. (2001). The five factor model and impulsivity: using a structural model of personality to understand impulsivity. *Personality and Individuals Differences, 30,* 669–689.

Wildes, J. E., & Marcus, M. D. (2013). Alternative methods of classifying eating disorders: Models incorporating comorbid psychopathology and associated features. *Clinical Psychology Review*, *33*, 383-394.

Wildes, J. E., Marcus, M. D., Crosby, R. D., Ringham, R. M., Dapelo, M. M., Gaskill, J. A. & Forbush, K.T. (2011). The clinical utility of personality subtypes in patients with anorexia nervosa. *Journal of Consulting and Clinical Psychology, 79*(5), 665–674.

Wonderlich, S. A., Crosby, R. D., Joiner, T., Peterson, C. B., Bardone-Cone, A., Klein, M. …Vrshek, S. (2005). Personality subtyping and bulimia nervosa: psychopathological and genetic correlates. *Psychological Medicine, 35*, 649-657.

Wonderlich, S. A., Joiner, T. E., Jr., Keel, P. K.,Williamson, D. A., & Crosby, R. D. (2007). Eatingdisorder diagnoses: empirical approaches to classification. *American Psychologist, 62*(3),167–180.

World Health Organization (WHO) (1992). *The ICD-10 classification of mental and behavioural disorders: Clinical descriptions and diagnostic guidelines.* Geneva: World Health Organization.

Appendix 1

Table 1. Descriptive statistics and differences between eating disorder subtypes and healthy controls age, BMI, duration of disorder, MPS, DII and EDAS subscales.

Variable	**AN-R** (n=59)	**AN-BP** (n=11)	**BN** (n=79)	**BED** (n=13)	**Control** (n=110)	**ANOVA**		
	M (SD)	**M (SD)**	**M (SD)**	**M (SD)**	**M(SD)**	**$F_{(4,268)}$**	**p**	**η^2**
Age (years)	21.19 (6.39)^{d**}	22.30 (7.65)^{d**}	22.15 (5.82)^{d**}	30.08(11.32)$^{(a,b,c)**e*}$	24.42 (8.19)^{d*}	5.09	<0.001	0.072
BMI	15.53 (2.89)$^{(c,d,e)**}$	16.88 (1.01)$^{(c,d,e)**}$	21.69 (4.29)$^{(a,b)**d*}$	32.53 (8.88)$^{(a,b)**(c,e)*}$	22.25 (2.68)$^{(a,b)**d*}$	58.66	<0.001	0.468
Duration of the disorder (years)	2.79 (3.44)$^{(b,c,d)**}$	6.35 (7.08)^{a*}	5.91 (4.85)^{a**}	9.77 (8.46)^{a**}	-	57.01	<0.001	0.138
EDAS								
EDAS total	49.25 (25.55)$^{(c.d,e)**}$	73.27(33.26)^{e**}	90.51(23.02)$^{(a,e)**}$	88.77(15.47)$^{(a,e)**}$	32.36(16.42)$^{(a,b,c,d)**}$	95.33	<0.001	0.588
Restrained eating	19.14(12.78)$^{(b,c)*e**}$	27.91(11.09)$^{(a,e)*}$	24.59 (8.81)$^{(a,e)*}$	19.54 (6.02)^{e*}	11.88(7.09)$^{(a,b,c,d)*}$	25.77	<0.001	0.278
Binge eating	10.86 (7.54)$^{(c,d)**}$	13.73 (8.49)^{c*d**}	26.84 (8.95)$^{(a, e)**b*}$	30.92(10.04)$^{(a,b,e)**}$	10.90(6.11)$^{(c,d)**}$	71.12	<0.001	0.516
Purging	1.81 (3.19)$^{(b,c)**}$	8.91 (7.09)$^{(a,e)**(c,d)*}$	12.19(6.01)$^{(a,d,e)**b*}$	3.69 (3.59)$^{(b,e)*c**}$	0.34(1.18)$^{(b,c)**d*}$	114.33	<0.001	0.631
Preoccupation	17.44(10.99)$^{(c,d,e)**}$	22.73(12.69)^{d*e**}	26.89 (9.18)$^{(a,e)**d*}$	34.62 (5.68)$^{(a,e)**(b,c)*}$	9.25(7.49)$^{(a,b,c,d)**}$	73.35	<0.001	0.461
MPS								
Organization	20.32 (4.50)	22.45 (4.09)	20.27 (4.18)	19.54 (4.58)	19.43 (4.35)	1.56	0.186	0.023
Standards	17.95 (8.19)^{e**}	18.91 (7.33)^{e**}	17.99 (7.27)^{e**}	15.77 (9.51)	13.31(6.26)$^{(a,c)**}$	6.85	<0.001	0.093
Mistakes	11.36 (8.49)^{e**}	12.36 (8.35)^{e**}	11.77 (7.52)^{e**}	13.62 (8.70)^{e**}	5.13(5.01)$^{(a,b,c,d)**}$	15.36	<0.001	0.188
Parental Criticism	7.92 (7.34)	11.00 (7.96)	10.01 (7.94)^{e*}	9.92 (7.29)	6.47 (6.18)^{c*}	3.55	0.008	0.051
DII								
DFI	15.12 (7.68)^{c**}	15.64 (7.37)	19.57 (7.71)^{a*e**}	16.46 (9.66)	14.33 (6.79)^{c**}	6.09	<0.001	0.084
FI	21.29 (8.98)^{e*}	22.27 (4.76)	22.22 (7.63)^{e*}	17.08 (7.19)^{e**}	25.75(7.84)$^{(a,c)*d**}$	5.97	<0.001	0.082

Note: η^2- partial eta squared; AN-R – anorexia nervosa restricting; AN-BP – anorexia nervosa binge-purging; BN – bulima nervosa; BED – binge eating disorder; BMI- body mass index; EDAS – Eating Disorder Assessment Scale; Preoccupation – Preoccupation with body image and body weight; MPS – Multidimensional Perfectionism Scale; Mistakes – Concern over mistakes; DII – Dickman´s Impulsivity Inventory; DFI – Dysfunctional impulsivity; FI – Functional impulsivity; a- statistically significant differences from AN-R group; b - statistically significant differences from AN-BP group; c - statistically significant differences from BN group; d - statistically signficant differences from BED group; e - statistically signficant differences from control group; * - $p<0.05$; **- $p<0.001$

Appendix 2

Mean scores of EDAS subscales in five classes on the 1st and 2nd measurement

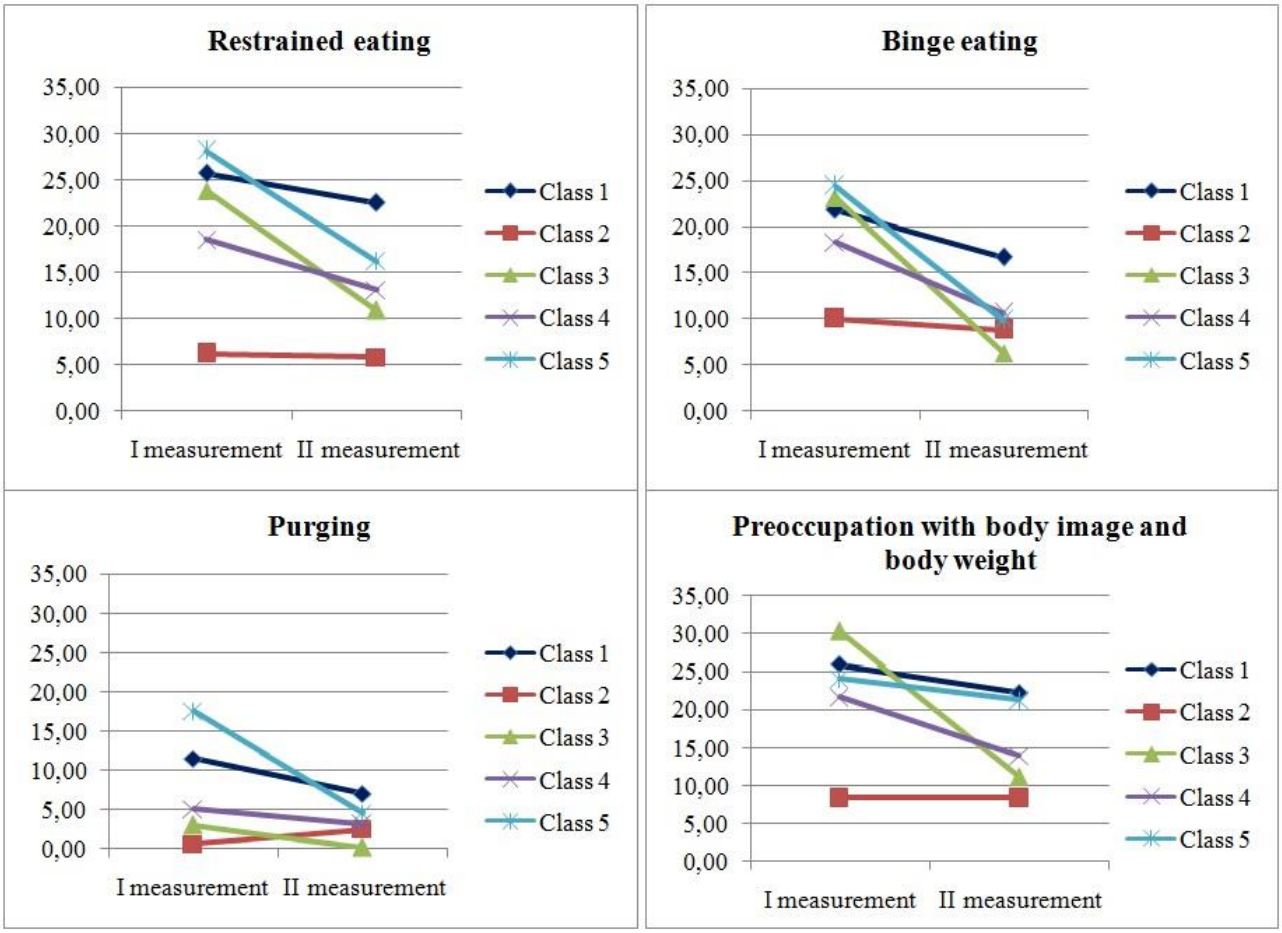

Figure 1. Eating Disorders Assessment Scale (EDAS) subscales mean scores in five classes on 1st and 2nd measurement.

Acknowledgements

I am very grateful to my supervisor Kirsti Akkermann for her support, encouragement and valuable feedback throughout the entire process. I would also like to thank Katrin Kukk for her encouraging feedback.

Non-exclusive licence to reproduce thesis and make thesis public

I, Kärol Soidla,

1. herewith grant the University of Tartu a free permit (non-exclusive licence) to my thesis „Facets of perfectionism, impulsivity and their associations with eating disorder symptoms: A latent profile analysis ”, supervised by Kirsti Akkermann, PhD.

1.1. to reproduce, for the purpose of preservation and making available to the public, includingfor addition to the DSpace digital archives until expiry of the term of validity of the

copyright;

1.2. make available to the public via the web environment of the University of Tartu,including via the DSpace digital archives until expiry of the term of validity of thecopyright.

2. I am aware of the fact that the author retains these rights.

3. I certify that granting the non-exclusive licence does not infringe the intellectual propertyrights or rights arising from the Personal Data Protection Act.

Tartu, **22.05.2017**